THURSDAY, DECEMBER 19, 1872

ARCTIC EXPLORATION

IT is now upwards of twenty-five years since the British Government sent out any expedition to those little known northern regions, the exploration of which has won so much glory to the British navy, formed such a splendid and peaceful sphere for the training of our sailors, and been so fruitful in the highest results to Science. Since that time, and especially during the last few years, every important civilised power in the world, except Britain, has been doing what it could to advance the interests of Science, which are coincident with the highest interests of humanity, by sending out expedition after expedition to force from the Arctic Regions the wonderful secrets which they have so long held in their icy grip. What has been done by other nations has been sufficiently detailed from time to time in these pages, and the knowledge thus gained cannot but be of the greatest service to any deliberately organised expedition which this country may send out.

About seven years ago the Geographical Society tried to move the Government to take action in the matter, and to fit out an Arctic expedition; but Government excused itself then on account of the want of agreement among geographers as to the most favourable route to be followed. Since then there has been much discussion on this point, and the results of recent expeditions have led to almost entire unanimity among those best able to judge as to the route which is most likely to be in every way attended with successful results. Therefore the distinguished deputation which on Monday waited upon the Chancellor of the Exchequer and Mr. Goschen was not one got up in hot haste as the result of some temporary excitement, but was the culmination of long discussion and deliberation founded on many years' accumulation of pertinent and valuable facts. The deputation was the bearer not merely of the desires and convictions of the distinguished scientific societies whom it represented. Arctic exploration has in this country ever been popular with all classes, and to judge from the earnest and enthusiastic tone in which most of our leading newspapers speak of the objects of the deputation, the public mind is as strongly set as ever on seeing that work completed which for so long has engaged theenergies of some of the greatest names on the roll of the British navy.

That the Government will forthwith respond favourably to the universal desire, when this has been so clearly, fully, ably, and unanimously brought before it by our most distinguished learned societies, we think there cannot be any doubt. What Government will do when reputable men of science come before it with a well-defined and important object has been shown in the expedition, so liberally fitted out, which has just left our shores on board H.M.S. *Challenger*. Indeed, we believe that Government would long ago have done something towards Arctic exploration had the matter been brought before it as powerfully and definitely as it was on Monday.

As was well urged by the deputation, without such an Arctic expedition as is wanted, the work which it is sought to accomplish by the *Challenger* must remain incomplete; the work set before that ship is of magnitude sufficient to engage it during all the time it will be abroad; and if Government is really in earnest in advancing the interests of science by marine exploration, it cannot choose but fit out an Arctic expedition as the indispensable complement to that which is about to explore the middle and southern latitudes of the globe. The answer that was given by the Chancellor was all that was asked, and all that we could expect; and it seems to us that if he and his colleagues do what he has promised—"carefully consider the matter, and read over the papers" laid before them—they can only form one opinion. We only hope that all sections of the Press—as the mouthpiece of all the various classes of the people—will say very unmistakeably what is the conclusion that all intelligent subjects of Her Majesty desire their purse-keeper, Mr. Lowe, and his colleagues to come to. If this and all other legitimate influences are used, and if Government treats the subject justly, and without prejudice, we have no doubt that by next May the resumption of Arctic exploration by this country will be a thing accomplished.

The deputation, headed by Sir Henry Rawlinson, represented the Royal Society, the Royal Geographical Society, the Geological Society, the Linnean Society, the Anthropological Institute, the Scottish Meteorological Society, and the Meteorological Office in London. Each of these bodies, in response to a letter from the Geographical Society, sent in papers showing the important objects to be gained from its own point of view, by a well-organised Arctic expedition. These papers, with the statements of the Geographical Society, maps, &c., were laid before the Government by Sir H. Rawlinson, and it is after the consideration of these that Mr. Lowe has promised to give his opinion. It is only needful here to state very briefly the points brought before Mr. Lowe and Mr. Goschen by the deputation.

Arctic authorities are now almost unanimous that the best route for an expedition to follow is up the west coast of Greenland to Baffin's Bay and Smith's Sound, one reason being that in this direction facilities are offered, in case of disaster, for retreat to the Danish settlements; besides, in this direction the most varied and most valuable scientific results may be obtained, and all seem agreed that this is the route along which the extreme north is most likely to be reached. The deputation thought that nothing better could be got in which to convey the expedition, than two strongly-built and thoroughly-strengthened Dundee screw-whalers of from 200 to 300 tons each, and each having a Government crew of 60 men and officers. These should start next May, and should be equipped and provisioned to carry on their work for three summers and two winters. One of these vessels it is proposed to station at some distance within the entrance of Smith's Sound, while the other would advance as far as possible to the northward, preserving communication with the dépôt vessel. From the point reached by the other, sledge parties would start in the early spring and explore the unknown region in various directions. By this means a wide extent of coast-line

would be discovered, and a safe return would be ensured; for the advanced parties would be able to fall back upon their consort, whence, in case of accident, the whole expedition could retreat to the Danish settlements in Greenland.

The direct advantages offered by this route are, the discovery of the northern side of Greenland, and the prospects of securing the most valuable results in the various branches of scientific research,—in geography, hydrography, botany, zoology, ethnology, geology, geodesy, and meteorology: but all the advantages to science cannot possibly be foreseen. Among the possible results enumerated by the Geographical Society are these:—Completing the circle of Greenland, ascertaining the extent and nature of its northern point, and discovering the conditions of land and sea in that area; supplementing the investigations of the *Challenger* expedition as to the bottom of the ocean; the probability of forest vegetation, proved to have flourished on what is now the Greenland coast, having extended over the Pole itself, thus confounding all previous geological reasoning as to the climate and conditions of the globe during the Tertiary period; a more complete knowledge of the teeming life of the Arctic Ocean; a knowledge of the customs and mode of life of the supposed dwellers in the unknown area, of whose former existence there is proof, who have no communication with the most northern known people, and who have probably been isolated for centuries; a knowledge of the kinds of microscopic vegetation inhabiting the northern Greenland seas, which would throw great light on investigation into the age of the rocks of our own island, and on the later changes of the climate of the northern hemisphere, besides the geological results, in rocks and fossils, and the observations on glacial action, which would be yielded by the examination of a long coast line; observations of the pendulum and of the dip and intensity of the needle; and observations as to temperature, pressure, winds, and currents. These manifold advantages, of the highest importance—in spite of the vague Philistine tirade of the *Times*—are confirmed and supplemented by the documents of the other societies.

As to the element of danger, it is clearly shown in the Linnean Society's paper that, as compared with explorations in Africa, Australia, and elsewhere, Polar voyages, North and South, show a comparative immunity from loss and hardship; and during the last few years experience has been so fruitful in her teachings, that the element of discomfort and danger may now be reduced to a minimum. The Geographical Society concludes its documents by adding to the other advantages that another generation of naval officers will be trained in ice navigation,—and they will be needed in 1882,—that opportunities will be offered for distinction, and that a great benefit will be conferred on the Navy, and through the Navy on the country. The belief is expressed that all classes of the people will unite with men of science in the desire that the tradition of Arctic discovery should be preserved and handed down to posterity, and that Englishmen should not abandon that career of noble adventure which has done so much to form the national character, and to give our country the rank she still maintains.

All this is irresistible.

FORESTRY IN ITS ECONOMICAL BEARINGS

TO what extent the climate of any portion of the surface of the earth can be changed by human labour is still an open question. Certain districts of the globe we are accustomed to look upon as condemned by Nature to perpetual sterility. The arid deserts of Africa and Central Asia, the frozen realms of Siberia, appear as if predestined to a gloomy lifeless solitude. To reclaim them to human control and human habitation may be one of the problems of the future. That climates have changed materially within recent times, we know as a historic fact. Macaulay has made us familiar with the damp fogs and perpetual rain-clouds with which our island was invested during the period preceding the arrival of the Danes and the Saxons. Much of the amelioration of climate which has since taken place is doubtless due to the increased cultivation of the land, and the extent to which the fen-districts have been drained; but the main agent has probably been the destruction of the forests which then clothed a large portion of the island.

The mode in which forests act in increasing the amount of moisture in the atmosphere is much misunderstood. Even in an article which recently appeared in the pages of so well-informed a journal as the *Pall Mall Gazette*, it is affirmed that this effect is due to the attraction exercised by the trees on the rain-clouds. The principle by which trees act in effecting this is, however, at least mainly, by acting as pumps in drawing up the superfluous moisture from the soil. The most trustworthy experiments show that, under normal circumstances, plants have no power of absorbing through their leaves water, either in the fluid or gaseous state; their supplies are obtained entirely through their roots; and the superfluous moisture is evaporated from the leaves. The amount of aqueous vapour thus delivered into the atmosphere by vegetation is enormous, and has been the subject of careful investigations by French and German botanists. Von Pettenkofer recently detailed* some experiments on the amount of evaporation from an oak tree, made during the whole period of its summer growth. He found the amount gradually to increase from May to July, and then decrease till October. The number of leaves on the tree he estimates at 751,592, and the total amount of evaporation in the year at 539·16 centimetres of water. The average depth of rainfall for the same period on the area covered by the oak tree would be only 65 centimetres; the amount of evaporation is thus $8\frac{1}{3}$ times more than that of the rainfall. The excess must be drawn up by the roots from a great depth; and thus trees prevent the gradual drying of a climate, by restoring to the air the moisture which would otherwise be carried to the sea by streams and rivers.

The immediate result, therefore, of the diminution of forests in a thickly-wooded country will be to increase the proportion of the annual rainfall that is carried to the sea by the natural drainage of the country, and proportionately to decrease the amount returned insensibly to the atmosphere, which then condenses into rain and cloud. Within certain limits it is obvious that this must be an unmixed good; but as the country becomes more and more thickly populated, and the land more

† Sitzungsberichte der k. bayerischen Akademie der Wissenschaften zu München, 1870, Band 1, Heft 1.

valuable for habitation or culture, the danger rather lies in the other extreme, that the country will become so denuded of forests as to render the climate too dry for the profitable pursuit of agriculture. This has, in fact, taken place of late years to so great an extent as to demand the most serious attention. In many parts of the continent of Europe great efforts are now being made to restore a portion of the forests which have been ruthlessly destroyed. At one Government establishment in Dalmatia five million young trees are now in cultivation for this purpose. In our Indian possessions the evil resulting from the destruction of the forests reached some years ago so gigantic a dimension as to demand the instant interference of the Government. The Indian forests are in themselves a source of great revenue, producing the most valuable teak, and multitudes of the more ornamental woods used in cabinet-work. But, independently of this, the most injurious consequences had resulted to the climate from their wanton destruction; the droughts, becoming constantly more frequent and of longer duration, brought terrible famine in their rear; and the swollen water-courses, when the rain did come, caused fearful devastations. The Government at length took the subject up, and in all our Indian Provinces the Conservancy of Forests is now an important branch of the Administration, though much yet remains to be done in consolidating and perfecting the system. In Mauritius similar results have followed similar causes. The fertility of the island has been diminished by the destruction of the forests; and the fever which a few years since decimated Port Louis is attributed to the malaria occasioned by the floods brought down by the torrents swollen far beyond their ordinary dimensions.

The literature of Forest Conservancy is, in fact, now enormous. The standard work on the subject, as far as India is concerned, is by Dr. Cleghorn,* the Conservator for the Madras Presidency, which gives a history of what our Government has been doing there. We are constantly receiving, however, from others of our colonial dependencies, official reports of the efforts being made in them for the preservation of the native forests; and it is impossible in this connection to avoid mentioning the name of Ferdinand von Mueller, the accomplished Curator of the Botanic Gardens at Melbourne, whose exertions in the introduction and acclimatisation of Australian forest trees in other climes have been unwearied and of inestimable value.

In Algeria the same tale is told as in India. Up to about the year 1865 the wanton destruction of the forests by the Arabs by fire and other means, was enormous; until at length the French Government took up the subject, ably aided by one or two English and French owners of land in the Colony. The tree found there most efficacious in repairing the waste, is not a native, but one of the family known in Australia as "gum-trees," the *Eucalyptus globulus* of Tasmania. The great advantage of the planting of this tree is, not only the value of its timber, but its prodigiously rapid growth, said to be fully twenty times greater than that of the oak. It has been introduced also with great success into the South of France, owing to the energy and enterprise of v. Mueller, and is hardy in this country. The foliage is said to secrete a gum-resin, which acts as a most valuable antidote to malaria fever.

* "The Forests and Gardens of South India." By Hugh Cleghorn, M.D. F.L.S. (London; W. H. Allen and Co., 1861.)

In the French department of the Hautes Alpes, an interesting experiment has been tried of a somewhat different character. The same results had there ensued from the same causes. Year by year the mountain villages had been abandoned, and in twenty years a diminution of population to the extent of 11,000 had taken place. An attempt to replace the forests met with the most violent opposition from the peasantry, and they were allowed to substitute "gazonnement" for "reboisement;" that is, the people were compelled to returf the barren and neglected districts. The effect is said to have been most beneficial. The fresh covering of the naked soil has prevented evaporation, and has allowed the rain to sink in instead of running off in destructive torrents; and districts which a few years ago were abandoned to desolation are now gradually acquiring a luxuriant vegetation, and giving food and shelter to the flocks and herds which had long been strangers to them; the streams are becoming clearer and less violent, and the bridges are no longer periodically carried away.

There is probably no department of Science to which human energy and ingenuity could be more profitably turned than the reclaiming of the waste places of the earth.

DANA ON CORALS

Corals and Coral Islands. By James D. Dana, LL.D. &c. (Sampson Low and Co., 1872.)

THE distinguished naturalist, geologist, and mineralogist, who is the author of this semi-scientific work, is probably, next to Charles Darwin, the man from whom an expansive book on coral formations would be expected. He has had immense opportunities for the careful investigation of all the phenomena of coral reefs, and his peculiar mental constitution has assisted him in all his endeavours to teach and to arrange. No geologist has equalled Dana in the arrangement of his work; and his celebrated book on that science is eagerly studied by teachers of all degrees. As a student of details, he may point to his Mineralogy with great pride; yet, with these powers and gifts ready at hand, Dana produces, late in life, this disappointing book. It is full of precious stones in ugly settings, and the gems are intermixed with much that is worthless. To the general public it will be almost a closed book for years and it is hardly worthy of a place in a purely scientific library. A great portion of the book is taken up by descriptions and remarks upon animals which are not corals, and which in no way affect or produce coral reefs or islands, and the old errors respecting coral productions are perversely introduced. All the notices and descriptions of the Actiniæ and Hydroidea might have been omitted, as they only confuse the subject, and surely such statements as refer coral making to (1) Polyps, (2) Hydroids, (3) Bryozoa, (4) Algæ, might have been left buried in the memories of those who have been teaching that the third and fourth named organisms have nothing to do with coral any more than oysters and sunflowers.

Writing about Actiniæ, Dana gives the following without reference:—"As to senses, Actiniæ, or the best of them, are not so low as was once supposed; for, besides the

general sense of feeling, some of them have a series of eyes placed like a necklace around the body, just outside of the tentacles. They have crystalline lenses, and a short optic nerve. Yet Actiniæ are not known to have a proper nervous system; their optic nerves, where they exist, are apparently isolated, and not connected with a nervous ring such as exists in the higher radiate animals." Now, the "bourses marginales" have highly refractile cells and elongated cells without nematocysts associated with them; then a mass of granular and opaque tissue separates them from some irregularly-shaped cells which are not peculiar to the spot, but which are found between the muscular layers also. Corresponding refractile cells are to be found on the tentacles. We have followed Schneider in these researches, and do not as yet feel disposed to recognise an optic organ.

The classification of the corals employed by Dana is, as might have been expected, not that followed by those men who have raised those Radiata from the Slough of Despond in which they were left by the predecessors of Lamarck. The introduction of American novelties, to the exclusion of well-recognised European classifications, is neither right nor scientifically correct. For instance, Dana mentions the "Oculina tribe, or Oculinaceæ," and, after giving his differentiation, proceeds:—"The Orbicella is an example of one of the massive Astræa-like forms constituting the Orbicella family, or Orbicellidæ, in the Oculina tribe. The Caryophyllia here figured (*Caryophyllia Smithii*, Stokes) is one of the solitary species of the tribe found in European seas and on the coast of Great Britain." "The corallum of an allied species (*Caryophyllia cyathus*)," Dana proceeds to inform us, is found "not only in the Mediterranean, but also over the bottom of the Atlantic, even as far north as the British Isles." "Another example of this tribe, as defined by Prof. Verrill, is the species of *Astrangia* occurring alive along the southern shores of New England, and on the west of New Jersey." The diagnosis of the Oculina tribe was the growth of the experience of Schweigger, and of Milne-Edwardes, and Jules Haime, and they separated the incongruous genera which Lamarck had associated with it. The admission of Orbicella, which is really the old Astræa of Lamarck, and of Caryophyllia into this well-differentiated tribe, is simply absurd, for they possess structural characters sufficiently diverse as to place them in different families. The discovery of *Caryophyllia Smithii* in the European seas was due to the investigations of the results of the late deep-sea dredgings of H.M.S. *Porcupine*, and those unrecognised workers have shown that it is not *Caryophyllia cyathus*, but *C. clovus*, which has the great horizontal range. Had Dana waited a little longer he would have had the opportunity of quoting correctly. Again, Astrangia was well differentiated long before Prof. Verrill was heard of. The American Conrad, and our Lonsdale, and finally, the distinguished French Zoophytologists, for whose labours our author appears to have a supreme contempt, inasmuch as he rarely gives them credit for their good work, consolidated the genus, which has nothing in common with the Oculinidæ.

Interesting and valuable chapters on the distribution of corals according to temperature, and on their limitation to certain areas, follow. Darwin is supported in his views of the 20-fathom range of reef-building corals, and some interesting data are given respecting the rapidity of growth of corals. A madrepore is stated to have grown 16 feet in 64 years; but the rapidity of growth depends upon the habit of the species, the freedom from the destructive effects of boring mollusca, nibbling fish, and wave-breaking, and is, under favourable conditions, very rapid. The chapters on the structures of coral reefs and islands add little to the knowledge which Darwin and Jukes and Hochstetter have given us; but Dana's great powers of illustration enable him to reproduce the details with which we are so familiar, thanks to these authors, in very engaging forms. He tells us, however, that in the reef, "The coral *débris* and shells fill up the intervals between the coral patches and the cavities among the living tufts, and in this manner produce the reef deposit, and the bed is finally consolidated while still beneath the water."

Noticing, then, the great power of the force of sea wave in smashing and removing masses of coral, and the effects of the passage upwards on to the beach of hard blocks in destroying and comminuting smaller zoophytes, Dana very properly insists upon the formation of what are usually called coral islands, from the collection of beached coral boulders, and suggests that the extreme grinding and pounding of the most fragile coral stems places the carbonate of lime, of which they are composed, in the best position for solution in highly aërated sea water. He notices the formation of mud in and about the reefs, and compares its origin to that of any other kind of sand and mud. "It takes place on all shores exposed to the waves, coral or not coral, and in every case the gentler the prevailing movement of the water the finer the material on the shore. In the smaller lagoons, where the water is only rippled by the winds or roughened for short intervals, the trituration is of the gentlest kind possible, and moreover the finely pulverised material remains as part of the shores." He shows that the particles of the very fine mud which is washed out from the beach sands accumulate only in the more quiet waters some distance outside of the reef, and within the lagoons and channels where it settles.

After remarking upon the abundance of fish around coral islands, especially in the instance of Taputenea, with an area of six square miles, whose population of 7,000 is supported by fishing, Dana notices the drifting of logs of wood on to remote islands. "An occasional log drifts to the shores, at some of the more isolated atolls, where the natives are ignorant of any land but the spot they inhabit, they are deemed direct gifts from a propitiated deity. These drift logs were noticed by Kotzebue at the Marshall Islands, and he remarked also that they often brought stones in their roots. Similar facts have been observed at the Gilbert Group and also at Enderby's Island and many other coral islands of the Pacific. The stones at the Gilbert Islands, so far as could be learned, are generally basaltic or volcanic, and they are highly valued among the natives for whetstones, pestles, and hatchets. The logs are claimed by the chiefs for canoes." These waifs and strays, and others, like the large masses of "compact cellular larvæ" lying 200 yards inside of the line of breakers on Rose Island, and the fragments of pummice and resin which, transported by the waves, are collected by the natives on their shores, are very interesting and suggestive to the botanist, mineralogist, and archæologist—more so, per-

haps, than to the natives, who are not admired by Dana, for they evidently lead too carnal an existence, and care little for poesy and the imagination.

After explaining the origin of gypsum in some of the smaller completed atolls by evaporation of sea-water in the gradually drying lagoon, Dana describes some of the guano deposits which collect on the coral limestone and saline mud, and mentions how these accidental additions with the stones and drift wood, explain many difficult geological and mineralogical problems. "Some interesting pseudomorphs occur buried in the guano of Baker's Island. Coral fragments of various species were found that had long been covered up under the deposit, and in some of which the carbonic acid had been almost entirely replaced by phosphoric acid. On such I have found 70 per cent. of phosphate of lime." This is an interesting fact, especially when it is remembered that birds' dung may have collected in all climates during many geological ages. The description of the geographical distribution of coral reefs is followed by a most interesting chapter on changes of level in the Pacific Ocean. The irregularity of the elevations and subsidences, even on confined areas, is admirably demonstrated. The formation of compact white limestones, and of impure or argillaceous limestones, and of beach or sand-drift rocks and oolitic limestones, is explained, but without reference to the admirable researches of Nelson, whose labours in the Bermudas are classical amongst European geologists. Then there is a sweeping assertion that deep-sea limestones are seldom if ever made from coral island or reef *débris*, and that lands separated by a range of deep ocean cannot supply one another with material for rocks.

The words "deep sea" are now differently understood to what they were in the days when theoretical views of the depth took the place of the results of real measurements, so that it is necessary to assert that abyssal seas may prove such barriers. But research into the lithology of the Atlantic near the Azores distinguishes mineral matters which, in all probability, are of American origin; and both in the Miocene deposits of the West Indies, and in those of the same age in Europe, there are proofs of the enormous aggregation of coral *débris* in deep limestones. Dana considers that the views, so ably put forward by Lyell and many American geologists concerning the derivation of the sedimentary rocks of the Appalachian strata from land to the east—that is to say, to the area of the present Atlantic—are unsound, because the wreck of the hypothetical continent could not have passed along the floor of the deep intervening sea. He states that the Atlantic would get back all its own dirt—an observation which would be trenchant enough, if geology did not prove the extraordinary distances to which sediments were removed from their sources.

The author is too keen a geologist not to notice this discrepancy in the size of the existing coral-limestone formations and those of the past, and he illustrates the possibility of considerable areas being now the seat of coral-limestone deposits by quoting the geography of the Abrolhos banks. The coalescence of the coral banks in shallow seas whose currents were not sufficient to cut deep and wide channels would account for the widespread and continental limestones.

An interesting notice of the occurrence of chalk in a raised reef in Oahu, near Honolulu, but which contained no traces of Foraminifera, is succeeded by essays on oceanic temperature and oceanic coral island subsidence. The Gulf-stream is stated to have had, from the Jurassic period in geological history onward, the same kind of influence on the temperature of the North Atlantic Ocean which it now has; and the British oolitic reefs are quoted as substantiating this assertion. Certainly during the Miocene the isthmus of Panama was under water, and vast tracts of the north of South America, and of the south of North America, and therefore the existence of a Gulf stream at that time may be doubted. Then there were stupendous reefs in the Italian and Austrian area, and the influence of anything like a Gulf stream would have had no effect upon them.

After noticing that coral islands are evidences of buried lands, Dana insists that "we are far from establishing that these lands were oceanic continents. For as the author has elsewhere shown, the profoundest facts in the earth's history prove that the oceans have always been oceans." This dictum is constantly in the mouths of some geologists, and its value may be appreciated by the remembrance that the existing continents are mainly composed of old sea, deep sea, and abyssal floors, and that very probably there has always been a comparatively exact relation between the amount of land and sea on the earth's surface. Moreover, there are very strong reasons for believing in a former Atlantis, and in a continent or a series of great islands between South America and New Zealand.

The illustrations of the book are numerous, and some of them are very correct representations of nature. The group of Caryophilliæ in page 42 is excellent, but British aquarium-keepers will hardly recognise the well-known *Carophyllia Smithii* on page 67. Many of the white etchings on the black ground are beautifully executed, and copies of them will make excellent diagrams.

P. M. D.

OUR BOOK SHELF

Bird-Life. By Dr. A. E. Brehm. Translated from the German by H. M. Labouchere, F.Z.S., and W. Jesse, C.M.Z.S. Parts iv. and v., 1872. (London: Van Voorst.)

THIS is a translation of a work well known in Germany, where it has attained great and in some respects merited success. "Das Leben der Vogel" is the production of one of a talented family, who have done much to popularise several branches of natural history. We do not say that it was not worth translation, but we do affirm that the translation is not worth half-a-crown a number—the price at which it is issued in this country—even when the value of Mr. Keuleman's nicely tinted lithographs is taken into account The idea of Brehm's book is to give a popular account of the way birds pass their lives in general and on particular occasions In the parts of the translation now before us the chapters relate to the "every-day-life," "courtship and marriage," "nest-building," and "migration" of birds. These are all described nicely enough, the author being an excellent field naturalist, and with sufficient accuracy, though in a very desultory manner. Anecdotes are often given from other authors, and stories from Dr. Brehm's personal experience, which has been extensive. But the work is a mere sketch of a history which it would occupy many volumes to

relate in a satisfactory manner. And, as we have already said, it is certainly not worthy of the luxurious paper and excellent print lavished upon it in the translation. In short, *le jeu ne vaut par la chandelle.* Messrs. Labouchere and Jesse might have spent their time and money in many other ways, to the greater advantage of natural history and of their own pockets.

Notes on River Basins. By Robert A. Williams. (London: Longmans and Co., 1872.)

THE river basins to which this little book refers are those of Great Britain and Ireland, and the notes are published, the author says, in the hope that they may be found useful to pupil-teachers. They are intended to form a supplement to the usual text-books of school geography. The rivers of England are given first, then those of Scotland and Ireland, each system being preceded by a general sketch of the course of the water-shed (or "water-parting," as Mr. Williams prefers to call it) of the country to which it belongs, and followed by a section on the canals. The author commences at one end of each country, takes the rivers in their order round the coast, names the drainage basin and source, describes the course and mouth, takes up and describes each tributary and affluent as it occurs, names and gives the measurements of any lakes which may be in the way, mentions the most remarkable features, and ends by giving the length of the main river and the area of its basin. So far as we have tested it the information seems in the main accurate, and the list of rivers and tributaries is remarkably full. Mr. Williams mentions the fall of the Rumbling Bridge on the Devon, a tributary of the Forth, but takes no notice of the equally high and equally grand fall of the same name on the Bran, a tributary of the Tay. It is surely very unusual to spell Dunkeld "Dunkield." The book will be useful to all who wish to have the main details concerning British rivers and canals carefully and clearly arranged in a handy form.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

The late Meteoric Shower

WE have had here, and I presume you also have had in England, quite a fine display of shooting stars from the fragments or companions of Biela's comet.

On Sunday evening, Nov. 24, they were coming about as fast as in the thickest parts of the August sprinkles—that is, forty or fifty to the hour, for a single observer. Three-fourths of them radiated from γ Andromedæ and vicinity.

On Monday morning there was no special abundance, but the radiant was then quite low in the north-west.

Monday evening they were coming with about half the frequency of the previous evening. Half of those seen came from the Andromeda radiant.

Tuesday evening the sky was overcast, but Wednesday evening there was so great a display as to attract the attention of multitudes. Our party of from two to six persons counted 1,000 in a part of the first hour—that is, from 6h. 38m. to 7h. 34m., and in the next hour and a quarter we counted 750. The display was rapidly diminishing. Before midnight it was essentially over, and, so far as I know, has not re-appeared.

The flights were slower than those of the Nov. 14 period, and generally faint. The radiant was carefully observed on Wednesday evening by Prof. Twining and myself, and we argued that the centre was in the line from the Pleiades to γ Andromedæ produced, and was about 3° beyond that star. It was much longer in right ascension than in declination, and was not less than 8° long. The star γ was within the radiant area, for flights in the several directions from the radiant would, if produced backward, pass sometimes on one side and sometimes the other of that star.

The character of this display, and the previously observed division of the comet into two parts, will, I doubt not, incline astronomers to the opinion of Dr. Weiss and others, who think that the shooting stars are products of the disintegration of comets already moving in closed orbits, rather than to the opinion of Prof. Schiaparelli that they are drawn from the stellar spaces into long parabolic currents. The latter hypothesis presents difficulties which I cannot explain.

Yale College, Dec. 2 H. A. NEWTON

IF the following translation of a letter I have received from Father Denza, Director of the Royal Observatory at Montcalieri, in Piedmont, will be of interest, it is at your service.

R. P. GREG

"Dear Sir,—A great shower of luminous meteors has just been witnessed throughout this country, and has no doubt been seen elsewhere. As soon as it became dusk falling stars were observed to fall continuously until midnight, and had it not then become cloudy no doubt they would have been seen until a still later hour. About 33,400 meteors were here counted by four observers. Even this number does not adequately represent the probable actual numbers. About 8 P.M. (when in some parts of the sky there seemed a real rain of fire) it was difficult to keep count, especially of those meteors appearing near the zenith; and at one time our four observers counted on the average 400 meteors every minute and a half. All the wonderful and beautiful appearances reminded us of the November shower. The meteors appeared of various colours; some left brilliant streaks; fireballs were frequent, some with an apparent diameter nearly equal to the moon's; some here and there breaking up in a thousand ways, as into a luminous cloud, or opening out into bundles of rays of singular shapes. From time to time some of these nebulous trains or appearances pursued their courses; or now vanishing or halting, only again to reappear. One of these, which appeared at 6h. 35m. between Perseus and Auriga, remained visible until 6.56, or 21m. after its first becoming visible. In short the general aspect of the phenomenon was that of a cosmic cloud which, encountering our atmosphere, appears and then melts away. The position of the *radiant*, which was accurately determined, was almost close to γ Andromedæ, and the epoch of the appearance induces one to suppose that the meteoric stream which we have just been traversing, and which in fact has been more or less seen every year, though with much less intensity might be the same which was seen by Brande, December 7, 1798, and again noticed on the same day in 1830 by the Abbé Raillard; in 1838 by Herrick and Flangergnes; later again in 1847 by Prof. Heis, of Münster; and in 1867 was recognised by Signor Zerioli at Bergamo. At the present time its point of contact with the earth's orbit must have taken place on November 27-28. Now it results from sufficiently probable calculations, that this meteor stream marks the orbit of the so much celebrated comet of Biela, the appearance or passage of which we have been expecting in the month of October of the present year, and for which astronomers are on the look-out. Most probably the large meteoric stream or cloud which produced this remarkable shower of falling stars last evening belongs to a part of this comet; so much the more likely when we consider that only yesterday the earth passed through one of the two nodes of this comet's orbit.

"A fine rose aurora was visible last evening from 6 to 8 P.M., adding to the beauty of the entire phenomenon.

"Yours respectfully,

"DENZA

"Montcalieri Observatory, Nov. 28, 1872

"P.S.—The shower was seen by many other Italian observers and astronomers—by Gasparis at Naples, who noted two meteors per second; Prof. Eugenio at Matera with three assistants counted 38,153 meteors between 6 and 12 o'clock; at Messina the number was too great to count; at Mandori Prof. Bruno and three assistants counted 30,881 meteors between 6h. 18m. and 14h. 15m.; at Ancona were counted 5,000 meteors per hour. The maximum appearance generally at all these stations was about 8 P.M., and the radiant was found to be not far from γ Andromedæ."

WHILE going to the Naval Observatory on the evening of November 27, I noticed many shooting-stars, and made the following observations:—From 6h. 25m. to 6h. 43m., Washington mean time, I counted one hundred meteors; and from 7h. 40m.

to 8h. om. I counted fifty meteors. The observer's face was north-west. The sky was clear to within ten or fifteen degrees of the horizon. The meteors were generally very small, and I noticed only four or five near the zenith that left trails behind that endured a few seconds. In one respect the meteors were remarkable: they all appeared to radiate from a point between the great square in Pegasus and the chair in Cassiopeia, so that during my two watches I saw but a single meteor that could properly be called sporadic. By laying down some of the tracks on a globe, I found the following rough position of the radiant point:—

$$AR = 355°, \quad Decl. = + 43°.$$

From this position of the radiant point I have computed the following elements of the orbit of the meteoric stream, and by the side of these have placed the corresponding number of Biela's comet:—

Meteoric Stream.		Biela's Comet	
π =	89·5°	π =	109·0°
Ω =	246·1	Ω =	245·9
i =	15·4	i =	12·6
$\log q$ =	9·976	$\log q$ =	9·933

These elements are so much alike, that there can be but little doubt that the meteors are the transformed particles of Biela's comet.

ASAPH HALL

Washington, Dec. 1

On the evening of November 27, Prof. Tingley, of Asbury University, Greencastle, Indiana, observed a remarkable shower of falling stars. The number counted in 40 minutes, from 7h. 15m. to 7h. 55m., was 110. This would give 165 per hour for one observer. But according to Prof. Newton (*Silliman's Journal*, for January 1868, p. 80), the whole number visible at any station, when the sky is entirely clear, is five times the number seen by a single observer. The enumeration by Prof. Tingley accordingly indicates an actual fall of 825 per hour.

It was remarked by the writer several years since* that the last days of November were worthy of close attention as the probable date of a meteoric shower. The same period had been previously designated by Mr. R. P. Greg, as an aërolitic epoch. The observed showers of falling stars which may be referred to this stream are as follows:—

A.D. 837, Nov. 12, cor. to Nov. 27 for 1850.
899, 18, Dec. 2 „
1850, 29
1872, 27

The epoch corresponds with that at which the earth crosses the orbit of Biela's comet. This body is no longer visible in its cometary form, having undergone the process of disintegration—a process which doubtless *commenced* at a very remote period. The fact, then, can scarcely be doubted that the meteors of this epoch are the results of this comet's gradual dissolution.

DANIEL KIRKWOOD

Bloomington, Ind., Nov. 28

The aurora of Nov. 27—the evening of the meteoric display—was seen by me near Liverpool. It appears to have been very partial in its manifestation, to judge by the published accounts. There was merely a hazy or diffused cloudy light, devoid both of colouring and symmetry of form. This variety of aurora I have observed on several occasions, when it appears to have attracted but few observers.

I may draw attention now to the fact of another display of aurora on Nov. 10 (noticed first at about 11.20 P.M.). This was of the usual form, ruddy, and radiating from a horizontal band of light in the north. It was followed by a week of much colder weather than had preceded it.

Liverpool, Dec. 13 SAMUEL BARBER

As the number of meteors which I counted on the evening of Wednesday last, November 27, varied considerably from the number in Mr. Lowe's tables (*Times*, November 29), I beg to offer you my observations, in case they should be of any value on account of the more southern point from which they were taken. I lay down on my back upon the flat roof of the house in which I live, and looked up towards the zenith. The radiating point of most of the meteors seemed to be in the area between Cassiopeia and Perseus. I observed a bright one between the stars representing the feet of Andromeda. It disappeared without traversing almost any visible track or angular distance, from which I drew the inference that it was near the radiating point. The number I counted was as follows:—

Time. h.	m.	No. in 5 minutes.	Average No. per minute.
6	34—39	150	30
6	39—44	140	28
6	45—50	150	30
6	50—55	180	36
7	1— 6	160	32
7	7—12	160	32
7	17—22	170	34
7	30—35	180	36
7	40—45	180	36
8	48—53	150	30
10	5—10	80	16
10	24 29	70	14

Between 8 and 8.30, a friend and I counted together about 50 per minute.

J. F. ANDERSON

Pau, Dec. 2

* "Meteoric Astronomy," p. 55.

The De Novo Production of Living Things

In reply to Mr. E. Ray Lankester's inquiry in the last number of NATURE, I beg to state that the specific gravity of an infusion of turnip, prepared in the manner I have directed, was found to be 1012, whilst that of an infusion of hay was 1005.

H. CHARLTON BASTIAN

University College, London, Dec. 16

The Ocean Rainfall

On reading the article on "The Meteorology of the Future," in NATURE, December 12, I pondered over this passage—"It is impossible to determine the rainfall over the ocean;" and it occurred to me that it is possible to do something in that line approximately. Is the *Challenger* supplied with rain-gauges? Would it not be possible to determine in some measure the hourly amount of rainfall over the ocean, in the zones of greatest precipitation, or in those of periodical rains, without detaining the ship unduly; and would not such data be useful in solving some of the problems connected with the working out of the law of cyclones?

Another suggestion has occurred to me—that is, that rain-gauges might be placed in "floating lights," and the rainfall at sea thus obtained. I need not now inquire through what channel this might be effected, or what particular structure and fixing of the gauges might be necessary. I should be glad to elicit the opinion of some of the readers of NATURE as to the practicability and utility of such a scheme.

S. H. MILLER

Wisbech, Dec. 14

Ocean Meteorological Observations

An examination of the discussion of the daily range of the barometer for square No. 3, published under Fitzroy's direction in 1861, which Mr. Symons has referred to at page 68 of this volume, shows that the results there arrived at can only be considered to be good as corrections for hourly observations of the barometer on the mean of the year. As regards the months, the results are, on account of the fewness of the observations on which they are based, too imperfect as indications of the true range to be available in correcting the averages on the large January chart issued by the Meteorological Committee. Since, moreover, the barometric range for January differs from that for the year, the hourly corrections for range on the mean of the year should not be applied to the January observations printed on the large chart.

Again, the prevalence in January of the south-easterly trades in the southern portion of the square, the prevalence of the north-easterly trades in the northern portion, and variable winds between, and the unequally clouded state of the sky which results therefrom, render it certain that range corrections must

differ considerably in different portions of the square. On these grounds, it would be a mistake, scientifically, to correct the averages of the actual observations on the large chart, in the present state of our knowledge. These should be printed with none except instrumental corrections; and as we have already said, the mean hour of the day and the mean day of the month of each average should be given; for if this be not done, the results of the discussion can be turned to no strict scientific use whatever.

But it is quite otherwise in discussing the data entered on the large chart, with the view of arriving at some knowledge of the distribution of pressure over this important part of the ocean. As we stated before, "such a discussion necessarily calls for a preliminary preparation of the results by the application of such approximate corrections for range as we are in possession of," and of these corrections Fitzroy's, to which Mr. Symons refers, are among the most valuable. To have attempted such a discussion, disregarding the correction for range, is a grave mistake; and we can scarcely suppose the Meteorological Committee will sanction it when they ultimately decide on the method of discussion to be adopted.

Fitzroy recognised the vital importance of range corrections in such discussions; and with this view the monograph above referred to was published under his direction upwards of eleven years ago. It would be well if a series of such monographs were prepared under the direction of the Meteorological Committee, as necessary preliminaries, which indeed they are, to the discussion of the meteorology of each portion of the ocean they undertake to discuss. YOUR REVIEWER

Rainfall at Barbados

I DO not know whether the following notice is worthy of admission into NATURE, but it suggests many interesting consequences as the effects of heavy rains over continents drained by large rivers.

A very intelligent naturalist, writing to me from Tobago, states:—

"During August we had an influx of fresh water all along our southern coast, and throughout the whole extent the sea eggs crawled ashore, and died in great numbers. No one has seen the like before. I have no doubt the fresh water was the cause of the mortality, and that other shells also suffered."

I have not the means of ascertaining the rainfall of the basins drained by the Orinoco and Amazon, but we in Barbados, and most of the islands in these seas, have been suffering for many months from a protracted drought. Have there been excessive rains on the Continent?

Tobago is at least 150 miles from the mouth of the Orinoco, and 900 miles from that of the Amazon. It is well known that the outflows of both rivers sweep round, and form a swift ocean current impinging on, and passing by, Tobago, whither they carry drift wood, seeds, and other products of the shore. But I never before heard of the quality of the water being affected to so great a distance.

I fear that no person had the curiosity to test the density or quality of the water. I shall inquire of my correspondent.

Barbados, Nov. 11 RAWSON W. RAWSON

Treatise on Probability

THERE has been no doubt as to the author or authors of the "Treatise on Probability," published under the superintendence of the Society for the Diffusion of Useful Knowledge, since 1844. In that year the "Value of Annuities and Reversionary Payments," by David Jones, was issued in two volumes by Robert Baldwin, of 47, Paternoster Row, and the title-page states—"To which is appended a 'Treatise on Probability,' by Sir John William Lubbock, Bart., F.R.S., and J. E. Drinkwater Bethune, Esq., A.M." Sir John Lubbock's name also appears on the opposite page, with his first Christian name properly affixed, and this is repeated at the end of the volume in a catalogue of the works published by that society. The treatise consists of 64 octavo pages, and was one of the best on the subject at the time it was first issued. The late Prof. De Morgan alludes to it in the English Cyclopædia, and Mr. Todhunter quotes "Lubbock and Drinkwater" no fewer than ten times in his "History of Probability," published in 1865. T. T. WILKINSON

THE HAWAIIAN VOLCANO, MAUNA LOA

THE following condensed account of the visit of a party to the summit of the Hawaiian Volcano, Mauna Loa, at present in a state of fearful activity, appears in the *Times* of November 23, from the pen of Prof. F. L. Clarke.

"From Kaalualu, on the southern side of Hawaii, where we left the steamer on the afternoon of the 4th, we procured horses and proceeded to Wiohinu, where we remained for the night, and started next morning; and, after travelling a distance of twenty-five miles over a very rough road, although it is considered one of the best, we reached Lyman's ranch, where we were kindly received, and passed the night. The following morning, at daylight, our friends having exerted themselves in procuring the services of an experienced guide, we resumed our journey, and after stopping at several ranches for rest and refreshment, during the forenoon of the 6th, we emerged from the woods, which opened upon an immense field of pa-hoe-hoe. The lava fields in this region exceed in wildness and confusion the most extravagant imagination. For miles around, as far as the eye could reach, great masses of once molten lava were tossed into a thousand grotesque shapes. After travelling several hours over the roughest kind of ground imaginable, we reached a rude kind of gateway that was formed by gigantic columns of lava rock, through which we passed, and reached the edge of a rough pali, from whence we were able to look out upon the summit. To our right rose a remarkable pillar, towering high up black against the sky, and on every hand yawned deep crevices and spent lava waves which had dashed together in various shapes and cooled.

"After reaching a favourable spot, where we left our animals secured for the night, we proceeded about 500 yards over a narrow strip of rugged lava, when we suddenly found ourselves upon the edge of the crater of Moku-weo-weo, on the very summit of Mauna Loa, situated about 1,400 feet above the sea level. Before us yawned a fearful chasm, with perpendicular black walls some 800 feet in depth, carrying the eye to where, in the darkness of the lower basin, there sprang up in a gloriously brilliant light a mighty fountain of clear molten lava, and looking across and below us, at a distance probably of three-quarters of a mile, there arose from a cone in the south-west corner of the lower basin a magnificent column of liquid lava, about seventy-five feet in diameter, that sent its volume of molten matter to a height of nearly 200 feet in a compact and powerful jet. The axis of this gigantic fountain inclined somewhat toward us, so that the descending cascade fell clear and distinct from the upward shooting jet, forming a column of continuous liquid metal surpassingly bright and beautiful to gaze upon. Flowing down the sides of the symmetrical cone, which the falling stream of lava was rapidly forming, were numerous rivers of liquid light, that as they flowed away, spreading and crossing, formed a lake of rivulets constantly widening and interlacing, which presented a beautiful and unique appearance.

"When we reached the summit of the mountain, the subdued roar of the pent-up gases was fearfully distinct as they rushed through the openings which their force had rent in the solid bed of the basin, and when we were in full view of the grand display our ears were filled with the mighty sound as of a tremendous surf rolling in upon a level shore, while now and again a mingled crash would remind us of the heavy rush of ponderous waves against the rocky cliffs of Hawaii."

Since the return of the party to Honolulu later advices state that the crater is increasing in action, and reflecting at night a light of unusual brilliancy, which reaches many miles off shore. The crater in Kilanea, since the present eruption of Moku-weo-weo, has been very irregular in its action, which leads to the supposition that the two alternate, that when one is active the other is passive.

ON THE SPECTROSCOPE AND ITS APPLICATIONS *

THE field of research which has been opened up by the spectroscope is one with which we have so recently become familiar, that it may almost be said that twenty years ago, a course of lectures on the spectroscope would have been an impossibility. The instrument, as we now know it, was only then in embryo, and even at the present time, although immense strides are every day

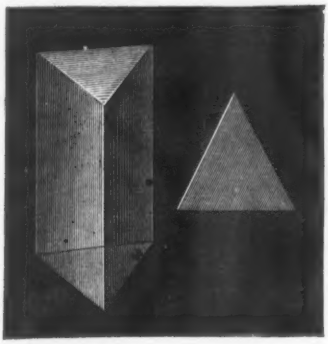

FIG. 1.—Geometrical form of the prism.

being made, the science of spectroscopy must still be considered in its infancy. And yet, so far as one can see now—it is always very easy to prophesy after the event—there seems very little reason why lectures on the spectroscope should not have been given two centuries ago; for

FIG. 2.—Prism mounted on a stand.

nearly two centuries have elapsed since the immortal Newton made his classical researches on the action of a prism upon sunlight. You may, perhaps, be inclined to ask, how it could take 200 years for the knowledge of the prism, and of the wonders that can be worked by it, to become part and parcel of our common stock of information? If you ask me to explain this, I tell you candidly that I cannot; but there is this grain of comfort connected with it which none of us should forget: we may almost say for certain that Newton and his successors would have brought a great deal more out of the prism than they did, if they had given a little more attention to it, and had tortured it as they did other things; that those who follow us will point to us and say the same; they possibly will say that in the 19th century, men of science, in working and experimenting, saw a great many things, and chronicled them, but did not care to go any further with them. This is very true; and the result is, that work is not done which might be done if we were more receptive and original in our methods of investigation; that is to say, if we trusted Nature more and ourselves less.

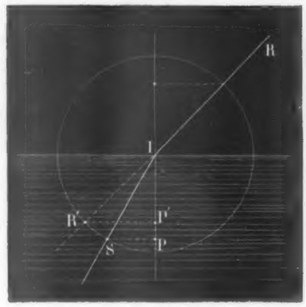

FIG. 3.—Refraction of light.

I propose that the first part of this lecture should in the main consist of an account of the prism and the principles of the spectroscope, and then of a description of the various kinds of spectroscopes which are now employed. I hope afterwards to go somewhat in detail into the applications of the spectroscope, not only with regard to terrestrial matters, but also with regard to those problems which we may possibly consider much grander, problems dealing with those celestial bodies which are sufficiently our neighbours to send us light.

Obviously, the first question we have to answer is this, What is a spectroscope? This I answer by saying that

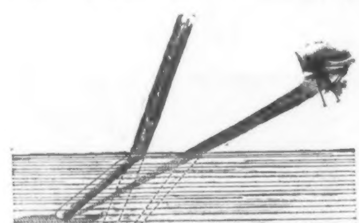

FIG. 4.—Explanation of the bent stick.

a spectroscope is an instrument in which the action of a prism or a combination of prisms is best studied. The next question, then, that arises, is, What is a prism? The accompanying figures (Figs. 1 and 2) will give a good idea of what is meant by a prism, and little time need be spent in description. It is usually a piece of glass—though it need not necessarily be so—bounded by five surfaces, two of which are parallel to each other—though they are not necessarily so—and three of which, bounded by parallel edges, cut each other at different angles; it is in reality shaped like a wedge. The importance of these different angles you will see by-and-by.

* Revised from the series of Cantor Lectures, delivered in 1869.

The discoveries of Newton, to which I have already alluded, were connected with prisms, and were based on well-known properties of light.

If a beam of light, as for instance sun-light or an artificial white light, be allowed to enter a dark room from a round hole in a shutter, it will simply travel in a straight line from its source; and to make it deviate from this straight line one of two things must be done. The beam must either be reflected or refracted.

The reflection of light is of very ordinary occurrence, for when light strikes any polished metallic surface, or in fact a surface of any kind, it is more or less reflected by it. The phenomena of reflection are so well known, the use of the mirror or looking-glass being perhaps one of

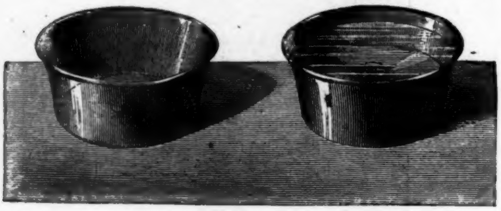

FIG. 5.—Refraction of light. Apparent elevation of the bottoms of vessels.

the most tangible, that no detailed reference need be made to them. The refraction or bending of light takes place when the ray passes obliquely from one medium to another of different density, as from air into water, or from water into air. A simple experiment may be made by passing the beam of light from above into a glass vessel containing water. If the ray strikes the surface perpendicularly, it will be seen that no visible change takes place, the ray simply proceeds directly into the water without altering its direction. If, however, the beam be allowed to fall on the surface of the water, say at an angle of about 45°, two things may be observed. In the first place a reflection will take place at the surface of the water—that is to say, the light will appear reflected at the surface, and it will be noticed incidentally that the angle at which the reflected ray leaves the water is precisely equal to that at which the incident ray strikes the surface, thus proving the rule that "the angle of incidence and of reflection

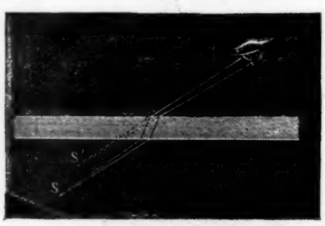

FIG. 6.—Light passing through plate of glass.

are equal." The second thing to be noticed is that on entering the water the direction of the beam of light will not be the same as it was in the air. In Fig. 3, the ray R I, striking the water at I, instead of proceeding to R′, is deflected or refracted to S; that is, the ray will be bent downwards, or, what is the same thing, towards a line, I P, perpendicular to the surface, to a definite extent, depending on the angle of the incident ray. The experiment may be varied by allowing the light to fall on the surface at various angles, when it can be shown that the angle formed by the ray refracted in the water varies in proportion to the angle of the incident ray, and that the angles formed are bound together by a regular law. Another fact may be observed, that the smaller the angle at which a ray of light strikes the surface of water, or, in fact, any transparent surface, the greater will be the proportion of light reflected at its surface.

Refraction may be clearly studied by plunging a stick into a vessel of water: the stick will appear bent at the point where it enters the liquid, as in Fig. 4, thus giving the appearance as if the stick were lifted or bent upwards. Another very instructive experiment is to place a coin at the bottom of a vessel, and then, standing so that the coin is just hidden by its edge, to gradually fill the vessel with water; the coin will appear to rise with the bottom of the vessel, and will become visible, as shown in Fig. 5.

The amount of refraction varies with the medium employed, and also with its temperature. The effect of different media can be clearly seen by passing a ray of

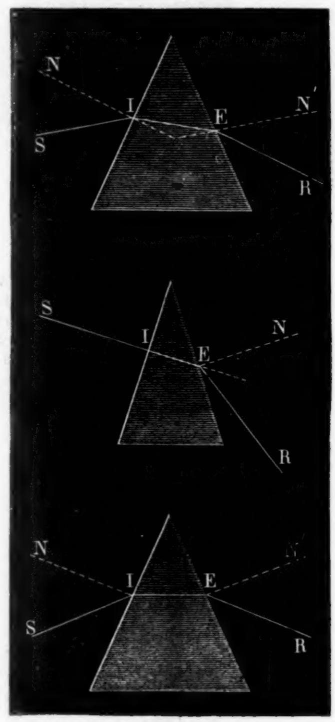

FIG. 7.—Deviation of luminous rays by prisms.

light into a vessel containing a liquid such as bi-sulphide of carbon, with a layer of water floating on the top. The ray will be seen to be bent on entering the water, and still more bent on passing from the water into the layer of bisulphide of carbon.

We have now to see what takes place when a ray of light enters a piece of glass. We will take first the case of glass with parallel sides. The ray on entering the glass at the upper surface is refracted downwards, as in the case of water, and travels through the glass until it reaches the under surface. Here we have precisely the reverse condition holding—that is, the ray of light passes from a dense medium to a rarer one. The ray is refracted upwards or away from the perpendicular line, and thus will exactly neutralise the previous refraction, and the beam of light will come out in a direction parallel to its original path, though not quite in the same straight line; as shown in Fig. 6, the ray, instead of proceeding in the direction of S′, proceeds in the direction of S.

If, then, a ray of light passes through a piece of glass, such, for instance, as a window glass, the surfaces of which are parallel, and inclined to the beam, you see when the beam passes through that the refractive effect is imperceptible. The reason of this is, that when we get the light falling on the glass from the air, then travelling

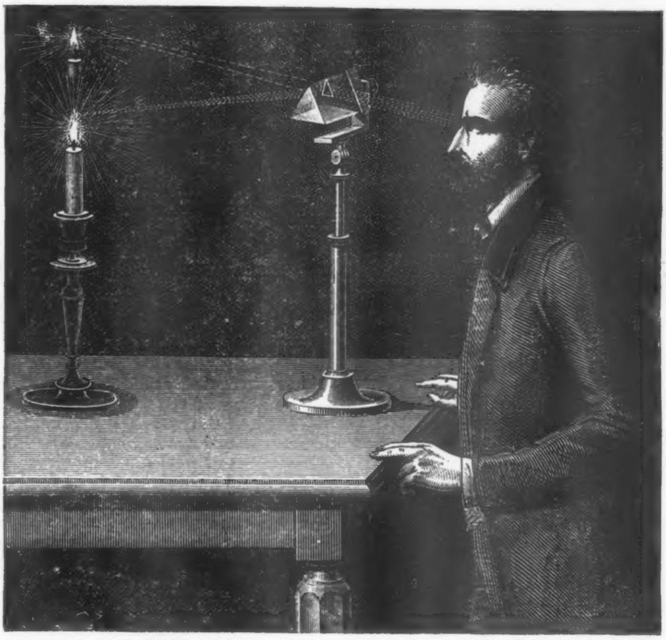

FIG. 8.—Images of objects seen through prisms.

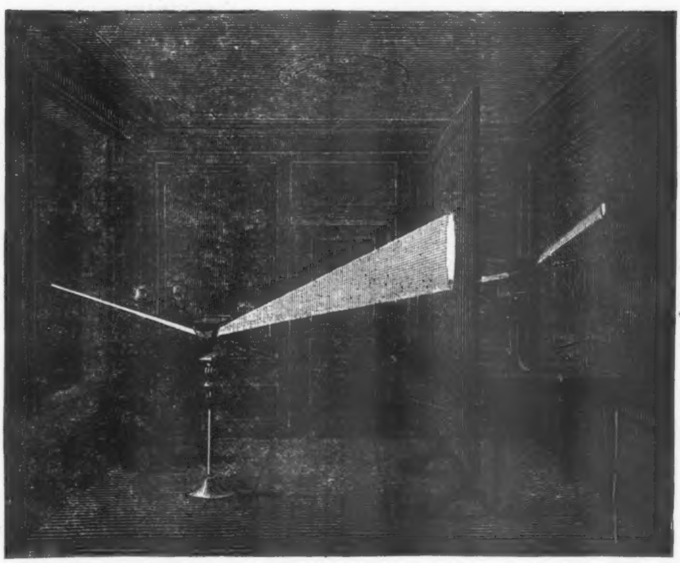

FIG. 9.—Decomposition of light by the prism. Unequal refrangibility of the colours of the spectrum

through the glass and coming into the air again, under exactly the same conditions, what is done at the first surface is exactly undone at the second, so that we get pretty much the same effect as at first. But now, if instead of having the glass bounded by parallel surfaces, we use a wedge-shaped piece, or a *prism*, the sides of

which are no longer parallel, you will see that there is a distinct alteration in the effect produced; the beam is directed to another portion of the wall altogether. The ray strikes the first side of the prism, and is bent towards the thicker part, or towards a line perpendicular to this surface, and on reaching the second side of the wedge, the ray is again bent in the same direction towards the base of the prism, for in this case the ray is bent away from the perpendicular to the second surface, and the light emerges from the second surface in a totally new direction. Fig. 7 shows the effect in three cases, the incident ray S I, the path in prism I E, and the refracted ray E R; N I and E N′ being the lines perpendicular to the surfaces. An experiment may easily be tried, which will confirm this. Let a triangular piece of glass be held, with one edge pointing upwards, between the eye and a lighted candle, as shown in Fig. 8; it will be found that the candle cannot be seen; but if the prism be gradually raised, the image of the candle will appear, the amount the prism will have to be raised depending on its angle. Now, we have here obtained a deviation or refraction of light—that is to say, it has been bent out of its course; for we have to look upwards to see the candle. Another effect has also been produced: the light which was white on entering the prism is now made up of several colours, which are separated more or less from each other; the candle, as seen in the last experiment, is not white, but is fringed round with colours. If we again take our beam of light in the dark room, as in Fig. 9, and allow it to strike on one of our prisms, so placed that its edges are horizontal, and also that the beam enters it obliquely by one of its surfaces, and then receive the image on a screen, we see a band of colours which reminds us strongly of the rainbow: the lowest colour, if the base of the prism be upwards, will be red, next above orange, passing by imperceptible gradations to yellow, and afterwards green, which then passes through the shades of greenish blue till it becomes a pure blue, then indigo, and finally ends with a violet colour. The transition from one colour to another is not abrupt, but is made in an imperceptible manner, so that it can scarcely be said, for instance, where the yellow ends or the green begins. The cause of this band of colours, or *spectrum* as it is called, was first discovered by Sir Isaac Newton, who tortured this spectrum in several ways. He took one of the colours thus produced, say red, as is shown in the figure, and made it pass through a second prism, receiving the image on a second screen; the image is found to be rather longer, but the colour remains unaltered. This experiment proves that this colour of the spectrum is simple, and the same has been found of all the others. As Newton in his experiment operated with sunlight, the band of colours was in this case called the *solar spectrum*. The rainbow itself is also in reality nothing more nor less than a solar spectrum, which is caused by refraction in the rain-drops.

If, instead of getting one beam of white light, we take two of differently coloured lights, red and blue, and pass these two beams of different colour through the same prism, you will see that the action of the prism on these two differently coloured beams will be unequal; in other words, you will get the red beam deflected to a certain distance from a straight line, and the blue deflected to a certain other distance. You see by this experiment that there is a distinct difference in the amount of refrangibility—that the red light is not diverted so far out of its original direction by the prism as the blue. And this leads us to Newton's first proposition, which is this:—"*Lights which differ in colour differ in refrangibility.*" I think that requires no explanation. You will be able to translate it for yourselves thus: Lights which differ in colour are differently acted upon by a prism, which, as you have seen, gives us a considerable result of the action of refraction.

J. N. LOCKYER

(*To be continued.*)

THE GEOLOGICAL EXHIBITION IN GLASGOW

THERE is probably no town or city in the United Kingdom, out of London, in which the science of Geology has been studied more extensively and enthusiastically, and to more purpose, than in Glasgow, during the last fifteen or twenty years. It is about fifteen years since the Geological Society of Glasgow was formed, and during the whole of that period the progress of the study and of the Society has never flagged, of which there was ample evidence afforded by a great exhibition of geological and mineralogical specimens which the Society held in the Corporation Galleries on the evening of Friday, December 6.

The Geological Society of Glasgow is one of the very few provincial societies, the results of whose scientific labours are permanently placed on record, and consulted by geologists elsewhere. The "Transactions" of the Society are now in the fourth volume, and in them there are embodied many valuable original memoirs bearing particularly on special departments of the geology of Lanarkshire and the West of Scotland.

The exhibition of the Society of which we are now giving a brief account, was chiefly devoted to an illustration of the fauna and flora of the Carboniferous system of the west of Scotland. Various members of the Society have worked most successfully in other departments of geological inquiry, but the function of the Society as a whole seems to have been especially the investigation of the Carboniferous system, and the elucidation of the many important physical problems connected therewith; and when we consider the fact that the exhibition in question was only a representation of the geological collections from which the specimens were obtained, we cannot help concluding that the Society's function has been performed with most surprising results to science.

Mr. James Thomson, F.G.S., corresponding member of the Royal Society of Liège, was certainly the chief exhibitor in the department of carboniferous fossils; but he was well supported by Messrs. Young and Armstrong. The first-named gentleman has done immense service during the last fifteen years, as a collector, particularly in connection with the fossil corals. His services in this respect have been extensively acknowledged at home—by the British Association and otherwise—and by Continental and American geologists, museums, &c. It is probable that, within the time named, Mr. Thomson has made sections of not fewer than ten thousand specimens of his favourite fossil corals. Besides the corals, Mr. Thomson's collection is peculiarly rich in reptilian remains, some of them quite unique and rare. Mr. Armstrong's specimens were generally representative of all the groups of animals and plants contained in the coal, ironstone, shale, and limestone series of the west of Scotland—Lanarkshire and the adjoining counties. Many of his cases excited great admiration. Besides being generally representative of the carboniferous system, Mr. Young was very strong in the Entomostraca and Foraminifera of that system, the species of which he has materially increased by his own discoveries.

In the department of Post-Tertiary shells, Mr. David Robertson, F.G.S., was without a competitor. Indeed, he has been such a devoted student of the Post-Tertiary period, that his collection is probably unrivalled. For a number of years the Rev. H. W. Crossley, F.G.S., now of Birmingham, was a zealous co-worker with Mr. Robertson. The Ostracoda and Foraminifera of the Carboniferous system, and the recent Hydrozoa and Polyzoa, were also largely represented in Mr. Robertson's cases.

Silurian fossils collected in the Girvan district, on the coast of Ayrshire, were shown by Mrs. Robert Gray, an enthusiastic naturalist; and from the Silurian system

some interesting specimens were exhibited by Mr. Dairon, whose collection was also specially rich in Graptolites from the neighbourhood of Moffat. Mr. Dairon exhibited Liassic fossils from the Whitby district, and Mr. Bell illustrated the Liassic system of the Isle of Skye.

Mr. Wünsch, one of the vice-presidents of the Society, was as strong as any exhibitor of volcanic minerals collected by himself on Vesuvius and Etna, and in the volcanic district of the Auvergne Mountains. The same gentleman showed specimens of the fossilised remains of a primeval forest which he found in association with volcanic ash on the shores of the island of Arran a few years ago.

There is no public museum in Glasgow that is worthy of the name in which these collections could find a home. Overtures have been made, in at least one instance, to secure many of the specimens for museums or for private collections elsewhere. It will afford room for profound regret if the ultimate possession of such collections should be diverted from the west of Scotland, where they have almost entirely been collected. Surely the wealthy coalmasters, ironmasters, shipbuilders, manufacturers, merchants, and others in Glasgow and the surrounding district, are not so supremely devoted to money-getting that they cannot amongst them raise a fund of a few thousand pounds to found a museum, the geological position of which shall have as a nucleus those priceless collections already referred to. Possibly some definite shape may be given to this idea when, in the course of the next few years, the British Association holds its third meeting in Glasgow, on which occasion the Glasgow geologists will not fail to gratify the longings of their geological friends elsewhere, many of whom have but a faint idea of the intellectual feast which is in store for them.

JOHN MAYER

THE RISING OF AUSTRALIA

OBSERVING that the gradual elevation of the land in the Australian portion of the southern hemisphere is attracting the attention of European geologists, I am induced to forward a few observations thereon, based upon personal investigation.

In March last, in a letter to the editor of this journal, under the title of "Circumpolar Land," Mr. Howorth cites a passage from my paper on the geological structure of this portion of the island, viz., Hobart Town. My remarks upon these post-pliocene evidences of terrestrial elevation were necessarily brief, owing to the various formations treated of in that contribution. I now therefore beg to draw the attention of the readers of NATURE to a few instances, in detail; for the reason that I am satisfied the question is one that demands the strictest inquiry in the present stage of geological science.

Upon reading a paper before the Royal Society of Tasmania, in November 1864, on these shell deposits as evidence of recent upheaval of the coast, I found the majority of the observers there present regarded them as having originated at the hands of the aborigines; as being, in short, the refuse of their camps. But I then pointed out the fact that there were genera and species of testaceous remains far too small to have been taken by the blacks for the purpose of food. One argument at that time raised against my deductions was the fact that in some instances fragments of charcoal were found associated with the shells. Where this is the case (though the instances known to me are few) I think I shall be able to show that it is to be traced to subsequent drift agency, and has no connection whatever with the formation of these shell beds.

One of the most interesting of these deposits is to be seen at Sandy Bay, an indent of the estuary of the river Derwent, distant from the city two miles. In a bank formed by a road-cutting distant sixty yards inland, and forty feet above high-water mark, exists a shell-bed three feet in thickness. The shells have a matrix of dark argillo-arenaceous soil, and beyond being more or less comminuted, especially the bivalves, exhibit few traces of geological age. Above the shell-bed reposes a stratum of vegetable soil a few inches thick. The shells rest upon a stratum of brown clay, having no traces of organisms; and that, in turn, reposes on coarse-grained yellow sandstone, traversed by veins of marl near its surface. The shells are all of genera and species now found living in the water only sixty yards in front of and below the deposit. They principally consist of *Mytilus*, *Turbo*, *Trochus*, *Delphinulus*, *Venus*, *Pecten*, *Ostrea*, *Patella*, *Cerethium*, and *Natica*. In this bed a spoon-bowl-shaped fossil bone was found by a labourer employed in making the road, five years ago. A cast of the bone I recently forwarded to one of the first osteologists of the age for identification. I have little doubt, however, that it is a bone of the hyoidal process of some Cetacean. It is $2\frac{1}{2}$ inches in length, by $2\frac{3}{4}$ in breadth, and presents no further signs of decay than the associated shells. At the distance of a mile from this spot seaward, there is another shell-deposit which has an average thickness of two feet, reposing on a basaltic overflow, and which again reposes on an arenaceous yellow clay, thickly perforated by Pholas. These beds are exposed in a vertical section of between thirty and forty feet in height.

Another locality where these evidences of recent elevation of the coast are plainly seen, is in the Queen's Domain, on the north-eastern boundary of the city, and in the immediate vicinity of Government House. Here, shells are exposed in the surface soil, 500 yards from the water-line of the estuary, but they are in a finely comminuted condition. They are thickly interspersed through the beds of the Royal Society's Gardens adjoining.

In the district of Lorrel, which is fourteen miles from the last-named locality in an easterly direction, there is a long low sandy flat, whose mean elevation above the sea-level I estimate at ten feet only. The arenaceous soil of this plateau is thickly studded for about two square miles with oyster shells, some of them being much larger on the average than what are taken now. This plateau is separated from a cliff of sandstone by an arm of the sea about one mile wide and very shallow. The cliff is about eighty feet high and is known as the Bluff. On the top of this cliff is an extensive deposit of oyster shells corresponding in character to those in the flat below. Now, if a line were drawn from this bed of shells to the deposits referred to around Hobart Town, it would be found to occupy a mean altitude of these beds. The conclusion, I believe, to be arrived at from the fact of the same species of shells existing at such different levels above the sea as those on the cliff and those on the flat, is that the former are older than the latter, though both without doubt belong to the post-pliocene epoch, and that the land has been gradually rising since the shells on the cliff contained their inhabitants up to the present time. That a silting up agency has been in operation with regard to the latter deposit is evident. The oyster shells are those known as the mud oyster here, its habitat being mudbanks. Now they are found dispersed through an incoherent sandy deposit, derived from the erosion of the sandstone formations on the opposite shore. The counter-agency of such silting up is, however, infinitesimally small when compared to the scale on which the land is rising.

I might multiply these instances of recent elevation of the land, did time and space permit, by mentioning numerous other examples round the coast of this island. Leaving Tasmania, and going to the Australian mainland, we find their analogues there. While on a geological visit to New South Wales and Victoria two years ago I was struck by the exact representatives of these sea

marks. In examining the shore of Hobson's Bay, Victoria, between Brighton and Mordiallac, I found recent shells in a ferruginous rock several feet above high-water mark, and exposed for more than a mile along the shore. This formation then gave place to a deposit of the same species of shells in a black sandy soil of the same character as those matrices mentioned as occurring here. I am thus able to add my humble testimony to the truth of the statements made by those geologists mentioned by Mr. Howorth. Not only do Tasmanian post-pliocene marine deposits find their analogues in New South Wales, Victoria, and other parts of the Australian mainland, but also the Miocene territory formations have their representatives there. For instance; at the East coast of this island seventy miles distant from Hobart Town, exist some very fine Miocene shell beds reposing on Silurian strata. These beds have their analogues in Victoria, at Schnapper point, where they also repose on Silurian strata. Again the somewhat celebrated Travertin deposit on the eastern bank of the Derwent, mentioned by Mr. Darwin, is completely represented at Geelong in that colony. I mention these last somewhat irrelevant features to show the analogy of physical conditions which existed in distant parts of Australasia from the middle Tertiary epoch down to the post-pliocene.

The oscillation of the land towards the Polar Regions is a question that demands strict and patient inquiry. That such a mutation is going on in this part of the globe, every intelligent geological observer is conscious of, and that at a computed rate of ten feet in the century. This is a fact which involves a variety of considerations with respect to past geological operations, and the popular theories propounded to explain them.

Although the land in this part of the globe is rapidly rising as well as according to published observations, that, in the Arctic regions, still I am in a position to show that an opposite movement took place during the close of the Tertiary or the dawn of the Pleistocene epochs by a sinking of certain tracts of land whereby Tasmania and New Zealand were isolated from the Australian mainland. I cannot do more at the present time than allude *en passant* to the important fact, and which must form the subject of a future communication.

Since writing the above I have examined a raised beach in the district of Sorrel, of many hundreds of acres in extent, composed of shells, having a mean thickness of five feet. The deposit is overgrown with trees and scrub. The trees are chiefly the Casuarina, or she-oak of the colonists, and it evidently flourishes on a soil of little else than shells. Although years ago lime burning was carried on for some years, so enormous is the deposit that there is scarcely a perceptible diminution.

Hobart Town, Oct. 1 S. H. WINTLE

THE COLOURED STARS ABOUT KAPPA CRUCIS

MR. H. C. RUSSELL, of the Sydney Observatory, sends us an account of some observations he has recently made on the above small but beautiful cluster of stars. He believes his researches probably point it out as one of the stations from which astronomers will gain fresh knowledge of the starry heavens. He gives a history of the cluster from its first recorded observation by Lacaille in 1750. Dunlop, about 1828, puts two stars in the place now occupied by ϕ, which has considerably altered its place since Herschel made his map in 1835. The star No. 87, Dunlop does not represent at all, and says nothing of colour, though fond of recording coloured stars. In 1835 Herschel wrote a monograph on Kappa Crucis, and placed all the stars (110) on his map, but saw no nebulous light. Abbott of Tasmania, in 1862, laid down 75 stars, and noted colours, remarking that certain changes were apparently taking place in the number, position, and colour of the component stars of the cluster. Nothing has been done since Abbott, till Mr. Russell determined to test for himself the latter's statement. He made a catalogue of all the stars (130) seen with the Sydney equatorial, a coloured map showing all the stars, and notes. His map takes in as much space as Herschel's, but is four times as large. A close inspection shows a great many changes since Herschel observed, of which the most conspicuous of all is in the change between the present and past position of three stars, Nos. 11, 21, and 28, which have all moved from 4 to 6 seconds; and the star ϕ has also moved half a second in an opposite direction, and come nearly, but not quite, in a straight line with δ and ϵ, which line, if produced, passes, not through ζ, as in Abbott's observations, but half way between γ and ζ. Considerable change has also taken place in Nos. 100, 106, 120, 122, 126, and some others; and it is remarkable that the changes in the south preceding line are nearly all in R. A., while in those near β and in the following side they are in declination, as if the cluster were made up of three sets of stars, two of which drift from the third in different directions. Five of Herschel's stars he could not see, but found 25 Herschel did not see; stars which, though all small, are yet in most cases brighter than some of those which Herschel recognised, and if there when Herschel examined, the cluster would not have been omitted; they are all well within the limits of his map, and several in parts of it which must have been most carefully examined. Two of them are near α, one near the string of stars south following it, one between β and δ, and two in the triangle 50s. after α, where Herschel shows 3 stars; of the others 5 precede α from 18 to 25s.; 5 follow it from 15 to 25s. and on the south side; 8 are on the north following side, and 1 on the south following. Their numbers in my list are 2, 3, 4, 6, 7, 16, 19, 31, 60, 69, 73, 76, 79, 86, 110, 116, 117, 120, 123, 124, 125, 127, 128, 129, and 130. In Mr. Russell's list there are 24 stars about the 10th magnitude, while in Herschel's there are only 7; and the mean magnitude of Herschel's 130 is 13, while the mean of Russell's 130 is 12.

These facts prove beyond all question, Mr. Russell thinks, that from some cause there has, as in the nebula of η Argus, been here a considerable increase in brilliancy.

Mr. Russell thinks that we must either give up analogy, our safest guide, in such reasoning, or admit the gradual extinction of light in its passage through space, with its millions of meteor streams cutting the ecliptic at all angles, its thousands of comets, its meteoric dust, its zodiacal light, its solar corona, its material atmosphere, so to speak, occupying not only all the interplanetary space, but more or less to the limit of the sun's attractive force.

"And if we are to take our sun as a type of other suns, and in the mind's eye see all surrounded by such an atmosphere, and people all the interspaces with myriads of myriads of comets—nay more, if we accept the view held to be most probable by many astronomers, that it is by the deposition of this material atmosphere on the sun and planets that they are hourly growing and finding those stores of light and heat by which all things live, it is beyond question that there must have been a time when this material atmosphere was far more dense than it is at the present moment, and that there must be in every direction other suns in all stages of the process from the great nebulosity '*without form and void*,' to the Finished Sun, whatever that may be; or, in other words, amidst the infinitude of such systems with which we are surrounded, there are places where probably a sensible amount of clearing up has taken place within the last 35 years.

"And I think in this view we find a rational explanation of the appearance of new stars in this cluster, more especially since it has been shown by others, as well as

myself, that in this region of the heavens about the remarkable star η Argus, strange clearings up, so to speak, or wanings of nebulous light have taken place, and many stars have come to view, with telescopes far inferior to Herschel's.

"And whether we admit this view or not, one thing is absolutely certain. Under such a material atmosphere we live and make our observations, and we are not yet prepared to say with certainty whether there may not be such changes going on in it as will suffice for a full explanation of the appearance of these small stars, if not of the great changes about η Argus."

NOTES

THE omission of a word in a note last week referring to the medals recently granted by foreign Governments to Englishmen, makes this journal appear to hold the opinion that it is to be desired that the British Government should thus signalise *British* work. Such, however, is most emphatically *not* our opinion. What we do hold is that if foreign Governments reward English work, it would be a graceful act for our Government from time to time to reciprocate such acts of international courtesy and good-will by marking in a similar manner its appreciation of *foreign* work.

IN the *Russian Official Gazette* is an announcement that a diploma of honour has been conferred upon Baron Liebig for the application of his knowledge of theoretical chemistry to practical purposes.

THE morning of Saturday the 21st has been fixed for the final despatch of H.M.S. *Challenger* on her long voyage. Her scientific staff—officers and civilians—are all on board, and the ship is busy from end to end, stowing and arranging her unwonted gear. As might be supposed, every available space is filled with books. Mr. Macmillan has received the thanks of the captain and officers and the civilian scientific staff, through Dr. Wyville Thomson, for a case of about fifty volumes of his newest publications, which he sent down as a parting gift.

PROF. HUXLEY has been elected Lord Rector of the University of Aberdeen, by a considerable majority over the Marquis of Huntly, a satisfactory evidence of the estimation in which eminence in science is held by the younger minds in Scotland.

WE regret to learn that M. Pouchet, of Rouen, celebrated as a leading champion of the doctrine of spontaneous generation, died in Paris on December 6.

THE following are the probable arrangements for the Friday evening meetings at the Royal Institution before Easter, 1873:—Jan. 17, On the Old and New Laboratories at the Royal Institution, by W. Spottiswoode, F.R.S.; Jan. 24, On the Analogies of Physical and Moral Science, by Rev. Prof. T. R. Birks; Jan 31, On the Music of the Future, by E. Dannreuther; Feb. 7, On Old Continents, by Prof. A. C. Ramsay, F.R.S.; Feb. 14, On Recent Progress in Weather Knowledge, by R. H. Scott, F.R.S.; Feb. 21, On Action at a Distance, by Prof. J. Clerk Maxwell, F.R.S.; Feb. 28, On Livingstone's Explorations in Africa, by Sir H. C. Rawlinson, F.R.S.; March 7, On the Temperature of the Sun and the Work of Sunlight, by J. Dewar; March 14, On Steamers for Channel Communication, by E. J. Reed; March 21, On New Alcohols from Flint, by J. Emerson Reynolds; March 28, On the Meaning of Force and Energy, by Prof. W. K. Clifford; April 4, Prof. Tyndall, F.R.S.

NATURAL Science at Rugby is producing its fruits. In the recent examination for honours at Oxford, six men were placed in the first class; and of these, four were educated at Rugby—Messrs. Baynes, Cleminshaw, Longstaff, and Lupton.

DR. HARRY RAINY, Emeritus Professor of Forensic Medicine in the University of Glasgow, has given a donation of 1,500*l.* to the University for the endowment of bursaries, to be competed for by students of Medicine.

DR. JOHN STENHOUSE is at present investigating the higher iodo-derivatives of the orcines.

THE Riberi triennial prize of 20,000 lire (800*l.*) has been awarded to Dr. Guiseppe Corradi, director of the surgical clinic at Florence, for four works on the diseases of genito-urinary organs.

AT the second meeting of the North British Branch of the Pharmaceutical Society of Great Britain Prof. Crum Brown gave an address on the relation of the science of chemistry to the art of pharmacy. He afterwards sketched the career of Scheele, the Swedish chemist and druggist, who had contributed a large list of facts to science.

PROF. FREIRE-MARRECO of Newcastle, and Mr. G. A. Lebour will lecture on January 8, and February 5, 1873, at the Rothbury Reading Room, on Artificial Lighting and on Caverns.

A VERY important paper has been printed by Government, respecting the *Phylloxera vastatrix*, or new Vine Scourge. It commences with a letter from Sir C. Murray, H.M. Ambassador at Lisbon, calling attention to the ravages of the disease; and stating that the Portuguese Government has named a Commission "to examine into the progress of this dangerous evil, and to gather from all quarters, whether scientific or practical (*sic*) suggestions for the best mode of extirpating it." A report follows from Mr. Crawford, H.M. Consul at Oporto, on the scientific aspects of the disease, as well as several others from French authorities, including a very important one addressed to the Minister of Agriculture and Commerce by the Commission instituted for the study of the new disease, M. Dumas, president. The various papers having been referred to Dr. Hooker for him to report upon them, he states that the only really effectual remedy at present discovered, and this can obviously be only very partially applied, and not in the best districts, is flooding the vineyards in winter. He adds "there is reason to believe that on the first symptoms of attack in isolated cases, the prompt destruction of the vine, its burning on the spot, and the subsequent treatment of the soil with some approved insecticide, such as carbolic acid, would be of great importance." Vines of American species appear at present to have enjoyed immunity from its ravages in the Rhone district, but the disease has undoubtedly appeared in this country on vines cultivated under glass.

THE South London Entomological Society, which, though only nine months old, has been extremely successful, held on Thursday evening last, at Dunn's Institute, Newington Causeway, a very interesting exhibition of collections of insects, chiefly British Lepidoptera. The collections were made by the members themselves, all amateurs, and do them the greatest credit. The room was densely crowded, and the exhibition was a great success.

A SOCIETY has been formed under the title of the National Health Society, which is to have for its object to help every man and woman, rich and poor, to know for himself, and to carry out practically around him, the best conditions of healthy living. The steps at present proposed are the holding of monthly meetings for the reading of papers; the establishing of classes for instruction in various branches of sanitary science; the delivery of free popular lectures; and the formation of a reference library and an information office.

A VIGOROUS attempt is being made to establish a Museum, principally in connection with Geology, Mineralogy, and Natural History, at the Giggleswick Grammar School, under the management of Mr. Style. The Settle Cave Exploration Committee have sent for the Museum the collection of fossils and other remains obtained from the Victoria Cave. The collection is of great and increasing scientific value, for the exploration of the cave is still going on under the auspices of the Local Committee and of the British Association for the Advancement of Science.

IN inserting in last week's *Les Mondes* a long and deservedly laudatory article from *Le Français*, on himself and his recently-started "Salle des Progrès," l'Abbé Moigno expresses a fear that he may be compelled to give up the project on which he has so enthusiastically entered, from want of means. We sincerely hope this may not be the sad end of the noble effort made by the Abbé to benefit his fellow-citizens.

THE following is from the *Times*:—"A despatch from Detroit, Michigan, states that on the night of November 25, Prof. Watson, of the Ann Arbor Observatory, discovered a new planet in the constellation Taurus. Its R.A. is 65° 25′; D. 19° 34′ N. It shines like a star of the tenth magnitude. Its motion is nearly parallel with the equator."

PROF. PETERS has named the two planets lately discovered by him (Nos. 122 and 123) Gerda and Brunhilda, and communicates to the *American Journal of Science* the elements of their orbits. The orbit of Gerda is remarkable for having both the inclination and eccentricity very small—a coincidence not found in any other known asteroids except in the case of Clytia. The planet No. 124 is now known as Aleste, and at the time of Prof. Peters's communication had the appearance of a star of a little less than the eleventh magnitude.

THE Naples correspondent of the *Times* states that for some time previous to her death Mrs. Somerville was engaged in writing her own life.

WE learn from the *School Board Chronicle* that the Netherlands Association for the promotion of labour and industry has awarded a gold medal to Madame Elise van Calcar, a well-known Dutch authoress, for her solution of the following prize question.—"How should girls be taught and educated so as to enable unmarried women to earn an independent livelihood, and the married to bring prosperity and happiness to their respective families?"

THE *Garden* says that the Royal Botanical Society of Belgium and the Botanical Society of France have just decided to make in common a scientific excursion next spring in the valleys of the Meuse and Scheldt.

THE *British Medical Journal* says a project is on foot to resume the publication of an Hospital gazette in Dublin, containing only original scientific matter. It would be published twice a month, would consist of sixteen pages only, and would be issued at an annual subscription of half-a-guinea.

THE existence of such a Society as the New Zealand Institute reflects the highest credit on our antipodal fellow-subjects, who, in their hard fight to make a home for themselves on the other side of the world, do not neglect the means of furthering their highest interests. The institution is a Government one, and was established under the provisions of the New Zealand Institute Act, 1867, of the General Assembly of that colony. It is the *alma mater* of all the societies in the colony that are devoted to the promotion of "science, literature, or art." These societies are incorporated or affiliated with it, and include the Otago Institute, the Philosophical Institute of Canterbury, the Auckland Institute, the Wellington Philosophical Society, and the Nelson Association for the Promotion of Science and Industry, representing all the leading provinces of New Zealand. The ordinary membership amounts to 600, and includes all the leading colonists residing in different parts of the several provinces. The Institute possesses a museum, laboratory, and library, which, with the work therein, are so organised and utilised for the benefit of the general public that they constitute in combination an important "Technical College," located at Wellington—a formidable, but, we hope, friendly rival to the recently established "University of Otago," which aims at becoming, among other things, an eminent school of applied science. The college is also the head-quarters of the Government Geological Survey, the chief members of the staff of which are professors to the Technical College, the lectures being of two kinds, general and practical. The former include natural history (zoology and botany, with their relations to physical geography and geology) and the elements of experimental science (physics, chemistry, and mineralogy). The practical is, in the meantime, confined to mineralogy and chemistry. Since the New Zealand Institute was established, in 1867, it has published no less than four bulky annual volumes, containing papers mostly of a scientific kind, many of which contain substantial contributions to science. All this promises well for the future welfare of the colony.

WE have received part I of vol. ii. of the "Transactions of the Edinburgh Geological Society," embracing the period between November 1869 and April 1872. It contains a number of very interesting and valuable papers on the geology of various districts of Scotland, including one by Sir Roderick I. Murchison, on the structure of the North-West Highlands, said to be the last geological paper written by Sir Roderick.

M. COLLAS, of Paris, comments in *Les Mondes* of December 12, on M. A. Lallemande's paper on the blue colour of the atmosphere, in which it was attributed to a change of refrangibility due to a partial absorption of the chemical or ultra-violet rays. In 1870 M. Collas, in an article in *Les Mondes*, attributed the blue colour of the Lake of Geneva and other waters to the quantity of silex held in solution, which is brought down by the tributary streams from the strata through which they pass. Numerous observations since have induced him to believe that the blue colour of all the water of the globe is due to the same cause. The air everywhere always contains more or less of moisture due to evaporation from the water of the earth, the water thus evaporated always contains a greater or less quantity of extremely fine insoluble particles. Silex, says M. Collas, is one of the most common insoluble substances in nature, and through evaporation, performs the same function in the blue sky that he believes it does in the blue waters of the earth. He believes his theory is confirmed by the intense blue of southern skies, where evaporation is so much greater than in the colder north.

THE question has often been debated whether flies eat the pollen of plants, or merely carry it away accidentally on their legs and backs. The question would appear to be set at rest by a paper read at the last meeting of the Scientific Committee of the Royal Horticultural Society by Mr. A. W. Bennett, in which it is stated, as the result both of his own observations and of those of Erm. Müller, that the microscopic examination of the stomachs of Diptera belonging to the order Syrphidæ, shows them to contain large quantities of pollen-grains, especially of plants belonging to the order Compositæ. Entomologists had

expressed a doubt as to whether it were possible for insects possessed only of a suctorial proboscis to devour such solid bodies as pollen-grains; but Müller believes that the transverse denticulations found in the valves at the end of the proboscis of many Diptera are especially adapted for chewing the pollen-grains, and for dividing the threads by which the grains are often bound together.

MR. FRANK BUCKLAND, writing to the *Times*, announces the birth in London, of a young rhinoceros (*R. sumatrensis*). The event took place at the Victoria Docks, on board the ship in which the mother had just arrived from Singapore; she, along with a male, having been captured by the natives of Malacca; the latter, however, died during the voyage. The young thing has been removed to the house of Mr. Rice, one of the owners of it and its mother, and we believe is getting along famously. We hope the "cockney rhinoceros," as Mr. Buckland calls it, may thrive as well as the young hippopotamus in Regent's Park, and not be permitted to cross the Atlantic, as, it seems, there is some danger of its doing, unless the Zoological Society secure it and its mother for their collection.

THE number of candidates for the ensuing matriculation examination of the University of Madras is 1,565, and the number of candidates for the first arts examination, 242.

JUDGING by the prospectuses which have fallen into our hands we cannot help concluding that the ladies of Glasgow are being well provided for in the way of lectures in the ensuing winter. No fewer than four courses are announced for their behoof. First, we have Dr. John Young, the Professor of Natural History in the University of Glasgow, with a course of sixteen lectures on his own special subject, and by means of which he proposes to give his auditors a comprehensive account of the animal kingdom, by selecting and dilating upon special and judiciously chosen types of animal structure, and their position in geological time. Next comes Mr. Edward Caird, the Professor of Moral Philosophy, with the same length of course, on the History of England, the range to be considered extending from the first period of English History to the time of Edward I., when the settlement of the principles of the Constitution was effected. This course will be open to gentlemen as well as ladies. A third University course of sixteen lectures is also announced, and will be open to gentlemen only, the lecturer being Mr. John Ferguson, M.A., Assistant to the Professor of Chemistry. These will be evening lectures, and, of course, the subject will be Elementary Chemistry. The Professors of Chemistry and Natural Philosophy in Anderson's University, apparently by way of supplementing the courses of biological and historical lectures of Profs. Young and Caird, have each commenced a course of twelve lectures for ladies, to be delivered in the Corporation Galleries, Dr. Thorpe taking Elementary Chemistry, and Prof. Forbes making Heat his special subject. These four courses of lectures for ladies will all be given at the same hour, but on different days, so that very zealous lady students may attend them all.

A CERTAIN Dr. A. Wolfert publishes an extraordinary article "in *Petermann's Mittheilungen*, Das Nordlicht eine weder magnetische noch electrische Erscheimung." The aurora, it appears, is neither electrical nor magnetic, but is the result of the reflection and refraction through the earth's atmosphere of the sun's rays remaining over from the summer!

AT the first ordinary meeting of the Pathological Society of Dublin, for the present session, held on Nov. 30, the President, Dr. George H. Kidd, announced that the subject chosen by the Council for competition for the gold medal, to be awarded to the best essayist in 1873, was "The Diagnosis and Pathology of Abdominal Tumours."

SCIENTIFIC SERIALS

THE *Geological Magazine* for November (No. 101) commences with a note on the forms of valleys and lake-basins in Norway by Mr. J. M. Wilson, in which the author draws attention to a connection which he has observed between the configuration of the surface of the country and the disposition of the principal planes of division of the rocks, this disposition apparently altering with the windings of the valleys. His notion appears to be that masses of rock have been torn away by glacier action until a divisional plane offering a minimum resistance to the passage of the ice was exposed.—The second article is the conclusion of Mr. Alfred Tylor's paper on the formation of deltas and on the evidence and cause of great changes in the sea-level during the glacial period, in which the author describes at considerable length the structure of the Delta of the Po (which is illustrated by sections of numerous artesian borings in Venice), and refers also to those of the Mississippi, Ganges, and Volga, in support of his views as to the peculiar curves formed by the surface of these deposits, his hypothesis of the former occurrence of a general "Pluvial" period, and his belief that during the glacial period there was an actual subsidence of the sea, due partly to its contraction by cold and partly to the abstraction of large quantities of water to form the enormous deposits of ice and snow in the colder regions. He also indicates the curves produced generally by denudation and deposition.—Mr. John Hopkinson describes some new species of Graptolites from the South of Scotland, including representatives of the genera *Dendrograptus*, *Graptolithus*, *Diplograptus*, and *Dicranograptus* from the Llandeilo rocks of Lanarkshire and Dumfriesshire; and a species of the anomalous genus *Corynoides* from the latter district. This paper is illustrated with a plate.—From Prof. Hall, of Albany, we have a note on the relations of the Middle and Upper Silurian (Clinton, Niagara, and Helderberg) rocks of the United States, written in opposition to Mr. A. H. Worthen, and in support of the generally received opinions upon this subject. The paper, although to a certain extent controversial, furnishes a useful summary of this department of American geology.—Mr. H. B. Woodward publishes a note on the Midford Sands, which he seems inclined to regard as truly transitional between the Upper Lias and the Inferior Oolite, and from this takes occasion to hint that the Keuper, Lias, and Oolites may be looked upon as one conformable series, the divisions or stages of which are to a certain extent arbitrary. The number concludes with the completion of Prof. Nordenskiöld's account of his expedition to Greenland in 1870.

Poggendorff's Annalen der Physik und Chemie, No. 9, 1872, contains two mineralogical papers, one by Vom Rath, on Anorthite, being a crystallographic study of the Naples collection; and the other by Dr. Lasaulx on Micromineralogy (second of a series), and treating of the metamorphic phenomena in protogine, granite, &c.—W. Stille discusses mathematically the theory of the boomerang's motion; and a paper by F. Braun treats of the influence of rigidity, fixture, and amplitude on the vibrations of strings; figures being given, showing the traces made by a feather (attached to the string), on a smoke-blackened cylinder, under varying conditions of the kind mentioned. F. B. Hofmann describes the spectral phenomena of phosphuretted hydrogen and of ammonia, and his paper is connected with one by F. Hoppe-Seyler on the production of light by atomic motions. Two of the Royal Society's papers, and one or two articles on chemical subjects make up the rest of this number.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 12.—"On the Structural Composition of Urinary Calculi." By H. Vandyke Carter, M.D.

"A Contribution to the Knowledge of Hæmoglobin." By E. Ray Lankester. According to the author the distribution of hæmoglobin may be summarised as follows:—

1. In special corpuscles.
   - *a.* In the blood of all vertebrates, excepting *Leptocephalus* and *Amphioxus* (?).
   - *b.* In the perivisceral fluid of some species of *Glycera*, of *Capitella*, and *Phoronis*.
   - *c.* In the blood of *Solen legumen*.
2. Diffused in a vascular or ambient liquid.
   - *a.* In the peculiar vascular system of the Chætopodous

Annelids very generally, but with apparently arbitrary exceptions.

b. In the vascular system of certain Leeches, but not of all (*Nephelis, Hirudo*).

c. In the vascular system of certain Turbellarians as an exception (*Polia*).

d. In a special vascular system (distinct from the general blood-system) of a marine parasitic Crustacean (undescribed), observed by Prof. Edouard Van Beneden.

e. In the general blood-system of the larva of the Dipterous insect, *Chironomus*.

f. In the general blood-system of the pulmonate mollusc, *Planorbis*.

g. In the general blood-system of the Crustaceans, *Daphnia* and *Cheirocephalus*.

3. Diffused in the substance of muscular tissue.

a. In the voluntary muscles generally of Mammalia, and probably of birds, and in some muscles of reptiles.

b. In the muscles of the dorsal fin of the fish *Hippocampus*, being generally absent from the voluntary muscular tissue of fish.

c. In the muscular tissue of the heart of Vertebrata generally.

d. In the unstriped muscular tissue of the rectum of man, being absent from the unstriped muscular tissue of the alimentary canal generally.

e. In the muscles of the pharynx and odontophor of Gasteropodous Molluscs (observed in *Lymnæus, Paludina, Littorina, Patella, Chiton, Aplysia*), and of the pharyngeal gizzard of *Aplysia*, being entirely absent from the rest of the muscular and other tissues, and the blood of these Molluscs, with the single exception of *Planorbis*, cited above (2 *f*).

f. In the muscular tissue of the great pharyngeal tube of *Aphrodite aculeata*, being absent from the muscular tissue and from the blood in this animal, and absent from the muscular tissue generally in other animals.

4. *Diffused in the substance of nervous tissue.*

a. In the chain of nerve-ganglia of *Aphrodite aculeata*.

Zoological Society, Dec. 3.—Viscount Walden, F.R.S., president, in the chair. The secretary read a report on the additions that had been made to the Society's collection during the months of October and November, amongst which were particularly noticed a Nippon Ibis (*Ibis nippon*), and other birds, presented by R. Swinhoe, H.B.M. Consul at Ningpo, China.—Mr. P. L. Sclater exhibited a nest of the Tigereta (*Milvulus tyrannus*), containing one egg of that bird and nine of the parasitic *Molothrus bonariensis*, which had been sent to him by Mr. W. H. Hudson, of Buenos Ayres.—Mr. H. E. Dresser exhibited a series of skins of eagles of Europe and India. After a careful investigation Mr. Dresser had come to the conclusion that three good species had hitherto been included under the name of the Imperial Eagle, four under that of the Spotted Eagle, and two under the name of the Tawny Eagle. Mr. Dresser pointed out the various plumages and localities of these species.—Prof. Owen, F.R.S., read a paper on the osteology of the Marsupialia, being the fourth of his series of papers on this subject. The present communication contained a description of the trunk and limbs of the Wombats (*Phascolomys*).—A communication was read from Mr. R. B. Sharpe, entitled "Contributions to the Ornithology of Madagascar."—A communication was read from Dr. J. E. Gray, F.R.S., on the Fossane of Madagascar (*Fossa d'Aubentonii*), of which animal the British Museum had recently received specimens.—A second communication from Dr. Gray contained notes of a Terrapin from British Columbia, which had been presented to the British Museum by J. K. Lord, as the *Actinemys marmorata* of Agassiz.—A communication was read from Sir Victor Brooke, Bart., giving the description of a new species of antelope from the river Gambia, living in the Society's menagerie, which he proposed to call *Nanotragus nigri-caudatus*.—A communication was read from Dr. A. Günther, containing notes on a hitherto unpublished drawing in the Buchanan-Hamilton collection, representing *Barbus beavani*. Three short communications were read from Mr. Andrew Garrett, of Tahiti, in which he gave descriptions of two new species of *Separatista*, two new species of *Caecum* from the Viti Islands, and a new species of *Scissurella* from the Panmotu Islands.

Geological Society, Dec. 4.—Prof. P. Martin Duncan, F.R.S., V.P., in the chair. "On the Tremadoc Rocks in the Neighbourhood of St. David's, South Wales." By Henry Hicks. The author stated that Tremadoc rocks occur in three distinct places near St. David's—namely, in Ramsey Island, at the north end of Whitesand Bay, and over a considerable tract of country about five miles east of St. David's. They rest conformably on the Lingula flags, and are about 1,000 feet thick in Ramsey Island. The author noticed the fossils found in these deposits, nearly all of which are of new species, and stated that the palæontological evidence proves these rocks to be nearly allied to, if not identical with, the lower part of the Tremadoc rocks of North Wales. The Upper Tremadoc rocks of North Wales seem to be represented at St. David's by the so-called Arenig rocks which overlie the deposits described in the present paper.—"On the Phosphatic Nodules of the Cretaceous Rock of Cambridgeshire." By the Rev. O. Fisher. The author stated that this paper was founded upon one read by him before the Society in May last, but subsequently withdrawn, in consequence of his obtaining information which necessitated a change of opinion upon certain points. The new portion related chiefly to those nodules which had been regarded as belonging to *Porospongia* or *Scyphia*, the fenestrated structure shown in sections of which the author now identified with the structure of *Ventriculites*, as described by Mr. Toulmin Smith, the whole arrangement, and especially the presence of an octahedral figure at the nodes where the fibres of the framework intersect one another, being in favour of this determination. The author described the peculiarities of these octahedra, and dwelt particularly upon the fact that these sections of phosphatic nodules showed clearly that the fibres are really tubular, and not, as Toulmin Smith supposed, solid.—"On the Ventriculitidæ of the Cambridge Upper Greensand." By W. Johnson Sollas. A collection of supposed sponges found in the Cambridge Upper Greensand had been in part referred to the genera *Scyphia* and *Porospongia*, and in part left unidentified. An examination of sections of these forms by the microscope had revealed all the details of Ventriculite structure; and a careful comparison with Mr. Toulmin Smith's descriptions and specimens had resulted in the identification of those examined with four of Mr. Smith's species; thus *Scyphia tessellata* was shown to be equivalent to *Ventriculites tessellatus* (or, more correctly, *V. texturatus*), *Porospongia ocellata* to *V. cavatus*, and other unnamed forms to *V. quincuncialis* and *V. mammillaris* respectively. The occurrence of ventriculite-structure in coprolitic material presents a favourable opportunity for a fresh inquiry into its nature; accordingly the author described the minute characters of the hexradiate elements of which the skeleton is composed, and the combinations of these hexradiates with one another. Abnormalities occur sometimes by the hexradiates becoming heptoradiate or pentaradiate, and sometimes by some of their rays bending quite away from their normal course. The whole of the skeleton fibre is distinctly tubular. Since the Ventriculite fibres have now been found fossilised in chalk, flint, and calcic phosphate, there can be little doubt that they were keratose, and not siliceous in their nature. If this be so, we have a difference between Nitrea and Ventriculitidæ of ordinal value at least, and we must look for allies to the Ventriculites among the horny sponges. *Verongia* resembles Ventriculites in the single hollow cavity of its fibre and the non-spiculate character of its skeleton; *Darwinella* offers a resemblance in its hexradiate horny spicules, and *Spongionella* in the regular arrangement of its fibres. These three genera are indices of the directions in which the Keratosa tended to vary. At a very early period great variation occurred among the Keratosa, which already, at the time of the Weisse Jura, had evolved such highly symmetrical specialised forms as the Ventriculites; these, with their contemporary variations, such as Verongioid forms, lived on in great numbers throughout the Mesozoic period, with the close of which the Ventriculites altogether disappeared; and their nearest allies dwindled down to the dwarfed and rare genera *Verongia, Darwinella*, and *Spongionella*.

Chemical Society, Dec. 5.—Dr. Frankland, F.R.S., &c. president, in the chair. The first two papers read were "On Hypophosphites" and "On the reducing power of Phosphorous and Hypophosphorous Acid and their Salts" by Prof. C. Rammelsberg.—A communication by Prof. A. H. Church, entitled "New Analyses of certain numeral Arseniates and Phosphates" followed, giving his results of the examination of the minerals, Fluonapatite, Arseniosiderite, Childerite, Uhlite, Tyrolite, and Wavellite.—"On the condition of hydrogen occluded by palladium as indicated by specific heat of the charged metal" by W. C. Roberts and C. R. A. Wright, D.Sc. This interesting

compound, which was discovered by the late Prof. Graham, Master of the Royal Mint, and supposed by him to be an alloy of palladium and hydrogen, is obtained on making metallic palladium, the negative pole in the electrolysis of water aciduated with sulphuric acid. The authors find, however, that the charged metal cannot be regarded as a true alloy of the two elements.

Anthropological Institute, Dec. 3.—Sir John Lubbock, Bart., F.R.S., president, in the chair.—Col. A. Lane Fox exhibited seven celts presented to him by Col. Pearce, R.A., who procured them from the grove and hill-top Temples of the Malayalis or hill-tribes of the Shevavoy hills, Salem, Madras Presidency. Col. Fox also read a report on Anthropology, at the meeting of the British Association at Brighton.—Professor T. Rupert Jones, F.R.S., read a paper "On Implements from the Caves of Périgord, France, bearing marks referable to ownership, tallying, gambling, &c." Among the implements of bone, deer-horn, and ivory found by MM. Christy and Lartet in the caves of the Dordogne district in France, are many bearing more or less definitely designed marks, such as scorings and notches, parallel, crossing, or otherwise arranged, and fittings in a roughly quincuncial order. One specimen in particular exhibited several of these kinds of markings, whether made for a purpose, for ornament, or by trivial whittling. Prof. Jones described several implements from the caves exhibiting one or more of these types of marks, and indicated their applicability to ownership, reckoning by tally, gambling, or mere fancy-work; he also suggested that therein we might have some of the earliest examples of magic signs and lucky charms, such as the old Norsemen and some Archaic people are said to have used and feared. Lieut. C. Cooper King, R.M.A., read a paper "On a Flint Implement Station at Wishmoor Bottom, Bagshot Heath." The interest of the discovery of flint chips and implements between Bagshot and Sandhurst lay chiefly in the peculiar nature of the locality in which these ancient traces of early human life were found. Apparently from the topography of the ground they had occupied the bed of a swampy valley which it was suggested had been, at the time of the deposition of the relics, a small lake area, near one of the great Western routes. It was further pointed out by the author that the flints themselves appeared not to be of local origin, and that the work performed at the place of discovery had probably been that of re-fashioning existing implements, rather than the construction of new ones from local flints.

MANCHESTER

Literary and Philosophical Society, Oct. 29.—Edward Schunck, F.R.S., vice-president, in the chair. Dr. R. Angus Smith, F.R.S., described a remarkable fog which he saw in Iceland. It appeared to rise from a small lake and from the sea at about the same time, when it rolled from both places and the two streams met in the town of Reykjavik. It had the appearance of dust, and was called dust by some persons there at first sight. This arose from the great size of the particles of which it was composed. They were believed to be from $\frac{1}{400}$th to $\frac{1}{800}$th of an inch in diameter. They did not show any signs of being vesicular, but through a small magnifier looked like transparent concrete globules of water. They were continually tending downwards, and their place was supplied by others that rolled over.

Nov. 12.—J. P. Joule, F.R.S., president, in the chair. Additional Notes on the Drift Deposits near Manchester, by E. W. Binney, F.R.S. An Account of some Experiments on the Melting Point of Paraffin, by Balfour Stewart, F.R.S.

Nov. 26.—J. P. Joule, F.R.S., president, in the chair. Dr. R. Angus Smith, F.R.S., said that he, like others, had observed that the particles of stone most liable to be in long contact with rain from town atmospheres, in England at least, were most subject to decay. Believing the acid to be the cause, he supposed that the endurance of a siliceous stone might be somewhat measured by measuring its resistance to acids. He proposed therefore to use stronger solutions, and thus to approach to the action of long periods of time. He tried a few specimens in this way, and with most promising results. Pieces of about an inch cube were broken by the fall of a hammer, and the number of blows counted. Similar pieces were steeped in weak acid; both sulphuric and muriatic were tried, and the latter preferred. The number of blows now necessary was counted. Some sandstones gave way at once and crumbled into sand, some resisted long. Some very dense siliceous stone was little affected; it had stood on a bridge unaltered for centuries, in a country place however. These trials were mere beginnings; he arranged for a very extensive set of experiments to be made so as to fix on a standard of comparison, but has not found time.—"On some points in the Chemistry of Acid Manufacture," by H. A. Smith, F.C.S.

NEW ZEALAND

Wellington Philosophical Society, July to September.—Weekly meetings have been held during the session, which was commenced by an address of the President, Dr. Hector, concerning certain matters that have been under discussion. Relative to the extinction of the Moa, he considers that there is evidence that they existed in Otago in considerable numbers within 200 years, and that a few may have survived to within seventy years. Referring to the first period in which Moas first appeared, he points out the absence of any evidence of there having been a Glacial period in the New Zealand area, there being no dispersed drifts. Nor is there any evidence of submergence since the last great extension of the glaciers which were coincident with a much greater elevation of the central ranges of the South Island than at present. Important contributions have also been made to the natural history of lizards, birds, and fishes of the colony by Dr. Butler, Captain Hutton, Mr. Travers, and others.—A series of papers is in progress by W. T. L. Travers, describing the changes effected in the Maories at the time they first acquired fire-arms and European implements, and when there was a sudden stride of a powerful race from the age of stone to that of iron.—An important paper by Captain Hutton on the geographical relations of the New Zealand fauna, in which he argues:—(1) A continental period in which South America, New Zealand, Australia, and South Africa were joined, which he places about the close of the Mesozoic. New Zealand was then separated, prior to the spread of mammals, and has since then never been completely submerged. (2) Subsidence followed, and a second continent connected, New Zealand, Lord Howe's Islands, New Caledonia, and Polynesia. (3) Subsidence then reduced New Zealand to a group of Islands, upon which the Moa lived, so that many species arose (4) Re-elevation joined the small Islands and mixed the different species of Moa which inhabited a large Island disconnected from Polynesia. (5) This was followed by subsidence, when New Zealand acquired its present form, and the Moas continued till they were destroyed by the Maories.

Sept. 17.—Captain Hutton read an elaborate paper on the date of the last great glacier period in New Zealand, and the formation of the Wakatipu Lake. The author, in opposition to the views expressed by Dr. Hector and to those held also by Dr. Haast, attributes the formation of the terraces that are so common in the valleys in the South Island to marine action, advancing the view that New Zealand has been submerged beneath the sea, since the valleys were eroded by glaciers the former extension of which he attributes solely to extreme elevation of the land during a preceding period, considering the view expressed by Dr. Hector that there has been a reduction of the area of land above the snow line by the erosive action of the glaciers as unnecessary and exaggerated. Speaking of the Canterbury plains, the author stated that Dr. Haast's sections show that they are nearly level in a line parallel with the coast between the Rangitata and the Waimakiriri, and that the gravel formation wraps round the spurs of the hills at the same level that it has at the river gorges, and considers that these facts and also the occurrence of vegetable deposits below the gravel of the plains, are readily explained by supposing these to be of marine formation, and quite inexplicable on the river formation theory. Another proof of recent elevation is the fact that the glaciers are now advancing and overriding their terminal moraines. The absence of striæ on the rock surfaces the author considers to be a strong proof that the glaciers were extended during the Pliocene, and not a more recent period. The origin of deep lakes, taking Wakitipu as a type, and the sounds on the West Coast were next described with the view of proving that their formation is not due to subsidence or unequal depression, but only to the scooping out of the rock by glaciers. Dr. Hector could not agree with the conclusions arrived at further than attributing the erosion of the Alpine valleys and the rock-bound lake basins to the scooping of ice. On the whole, he thought, no proof had been advanced of any Pleistocene submergence beneath the sea of the Alpine district since the excavation of the great valleys by the glaciers. After quoting Sir Charles Lyell, who points out that the time required for similar excavations is so extensive that it covers a period during which we know that great oscillations have taken place, Dr. Hector drew attention to the irregularity

in the movement of the land during the earthquakes of 1848 and 1855, which amounted to 9 ft. elevation at Palliser Bay and was not perceptible at Porirua, while there is good reason to believe that in Blind Bay there was a marked depression. The elevation of the Billy Rock in this harbour, and the depression of the Hapuku Rock at the Astrolabe since the publication of the Admiralty Charts, was also advanced as evidence that unequal movements have taken place on a small scale, and of course such may be cumulative throughout long periods.

Sept. 25.—Referring to the skeletons of the huia which were exhibited, Dr. Hector pointed out that the great difference in the length of the beaks in the male and female huias is due only to the prolongation of the horny mandible of the latter, the jaw bones being the same size in both sexes. This is not like the kiwi, in which the apparent excess in the length of the beak in the female is really produced by the lengthened bones of the face. Anatomically, the kiwi has the shortest beak of any known bird of its size. The strong mucular crest on the skull of the male huia at once distinguishes it, however, and supports the view that the male beak is used as an adze, and the female as a probe.

PARIS

Academy of Sciences, Dec. 9.—M. Faye, president, in the chair.—MM. Littré and C. Robin presented their Medical Dictionary to the Academy together with a short descriptive note.—M. de Saint-Venant read the second portion of his paper on the division of the force of a vibratory movement into those due to simple oscillatory movements of various periods and amplitudes.—M. Jamin read a note on the distribution of Magnetism. This was a criticism on M. Treve's paper on this subject, read at the last meeting. The author disagrees with his statement that the poles of a magnet are displaced when an armature is applied.—M. Pasteur promised on a future occasion to reply to the observations of MM. Béchamp and Estor, made at the last sitting.—M. Claude Bernard then answered M. Bouillaud's criticism on his late paper on animal heat: he defends the generally received theory that animal heat is produced in the capillaries; he denied that he stated it to be produced in the liver; and argued against Lavoisier's old theory that it arose solely in the lungs. M. Bouilland replied, and defended Lavoisier's theory, which he considers to be proved beyond doubt. M. Milne-Edwards then spoke on the subject: he alluded to the experiments of his brother, William M. Edwards, which proved that carbonic anhydride continued to be evolved from the lungs of an animal when it was deprived of oxygen, thus showing that the former gas was brought by the blood into the lungs, and not formed in them by the act of inspiration. A letter from Father Secchi, dated Rome, November 22, was then read. It related to the solar spots and diameter: he has observed the diameter on the lines *B* and *C*, and finds that each gives different results; this he explains thus:—*B* gives the solar diameter without the chromosphere, *C* the diameter plus the chromosphere.—M. E. Belgrand read a paper on the floods of the Seine and its affluents; after which MM. Is. Pierre and Ed. Puchot read some observations on several groups of isomeric substances derived from the alcohols of fermentation. The authors draw attention to the remarkable resemblances and differences in certain isomeric bodies, *e.g.* many isomers differing immensely in boiling-point, odour, and density at the boiling-point, have the same density exactly at 0°.—M. Burdin read a paper entitled a "Glance at the immense part played by ether in Nature," a paper relating to the luminiferous ether.—The following gentlemen were then appointed judges of the Montoyon Prize for Medicine and Surgery for 1873:—MM. Cloquet, Nelaton, Cl. Bernard, Bouillaud, Robin, Sèdillot, Andral, Larry, Milne-Edwards. The following were appointed to award the Montoyon Statistical Prize:—MM. Ch. Dupin, Mathieu, Boussingault, Morin.—A Report on M. Alph. Milne-Edwards' researches on the anatomy of the semules was then read, and it was decided that the memoir should be inserted among those of foreign *savants*.—Memoirs were received from M. Rosmann on analytical researches on rocks as regards their constituents which are absorbable by vegetables: it was sent to the section of Rural Economy.—On the destruction of the *Phylloxera* from M. Erb, and M. Balissat: sent to the *Phylloxera* Commission.—A note from M. Borrelly giving an account of the discovery and observations of planetoid 128 at Marseilles was then read, and followed by a paper on Geometry of N dimensions by M. Jordan; and by a note from M. Quet on the force of a vibrating system.—M. Sainte-Claire Deville presented a note on the thermic effects of Magnetisation by M. J. Moutier, which was followed by the conclusion of M. Th. du Moncel's paper on the accidental currents which are produced in a telegraphic wire, one end of which remains insulated in the air.—A very short note on electro-magnetism was then received from M. Trèves, and M. Wurtz presented a paper on dibenzyldicarbonic acid by M. Franchimont.—M. H. Byasson's paper on the splitting up of the molecule of chloral-hydrate under the influence of heat and glycerine was then read. At 110° the chloral-hydrate begins to split up into chloroform, hydrochloric acid, and allylic formiate.—M. A. Commaille read a paper on parathionic and thio-amylic acids. These acids, the last of which is isomeric with sulphamylic acid, are found in the mother liquors of coralline.—M. de Quatrefages presented a paper on a new species of chondrostome found in the waters of Rouergne by M. de la Blanchère. The systematic name of the new species is *Chondrostoma Persei*.—A note on the eye of the Germon, by M. Em. Morceau, was then read, and followed by a note on the immediate cause of the variations of the magnetic elements of the earth, by Father Sanna Solaro, who suggests that the ordinary diurnal variations are due to the movement of the sun acting on the statical electricity of the whole mass of the earth and its atmosphere. This movement continually displaces the resultant of the electric actions, and the instruments follow this movement. The perturbations are produced in the same manner.—A note on a Turonian colony in the Senonian stage of Saint Martory (Petites Pyrénées), by M. Leymerie, was then read.—A note on the origin of the planetary week and on Plato's spiral, by M. Sédillot, followed.

BOOKS RECEIVED

ENGLISH.—The Eruption of Vesuvius, 1872; R. Mallet (Asher and Co.).—The Natural History of Plants, vol. 2: H. Baillon (L. Reeve and Co).—Report of the Meteorological Observations in the North-western Provinces of India, 1871: M. Thomson.—Travels in Indu-China and the Chinese Empire: L. de Carné (Chapman and Hall).

FOREIGN.—Memorandum des Travaux de Botanique, 1772-1871; E. Morren (F. Hayez).—Histoire des Sciences et des savants depuis deux siècles: A. de Candolle (H. George).—Zeitschrift fur Biologie Band 8, Heft. 3.—(Through Williams and Norgate).—Das Leben der Erde: Hummel.—Grundrisz der Physik u. Meteorologie: Dr. J. Muller.—Untersuchungen uber das Wesen des Lichts und der Farben: D. Warmann.—Physikalische u. chemische Untersuchungen Uls u. Hummel.

DIARY

THURSDAY, DECEMBER 19.

ROYAL SOCIETY, at 8.30.—Magnetical Observations in the Britannia and Conway Tubular Iron Bridges: Sir G. B. Airy, Pres. R.S.—On the Organisation of the Fossil Plants of the Coal Measures, Part iv.: Prof. W. C Williamson, F.R.S.—Observations on the Temperature of the Arctic Sea in the Neighbourhood of Spitzbergen: Capt. Wells, R.N.

LINNEAN SOCIETY, at 8.—On the General Principles of Plant-construction: Dr. M. T. Masters, F.R.S.

CHEMICAL SOCIETY, at 8.—On the Polymerides of Morphine and their Derivatives: E. Ludwig Major and Dr. C.R.A. Wright.—Analysis of Water of the River Manaunddy: E. Nicholson.—Communications from the Laboratory of the London Institution: Dr. H. E. Armstrong.—On the Formation of Crystallised Copper Sulphide, &c.: J. L. Davies.

SATURDAY, DECEMBER 28.

ROYAL INSTITUTION, at 3.—On Air and Water: Prof. Odling, F.R.S.

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